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Short Test Correlation Analyses on 300, 1975 Model Year Cars. Volume II

Aerospace Corp, El Segundo, Calif Mobile Systems Group

Prepared for

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VOLUME II

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16. ABSTRACT

A series of statistical analyses was performed to determine the degree of "correlation" that exists between two specific short tests (STs) and the Federal Emission Certification Test Procedure (FTP) for new vehicles. This work was performed to determine if "reasonable correlation with certification test procedures" exists; this is a condition precedent to the promulgation of regulations that impose the in-use warranty provisions of Sec. 207(b) of the Clean Air Act of 1970 upon the motor vehicle manufacturers.

The basis for the analyses was ST and FTP test data from (a) three 100-vehicle 1975 model year fleets located in (1) Chicago, Illinois, (2) Houston, Texas, and (3) Phoenix, Arizona, (b) a 117-vehicle 1975 model year fleet located in Denver, Colorado, (c) a 147-vehicle 1974 model year fleet located in the greater Detroit, Michigan area, and (d) a 40-vehicle catalyst-equipped "1975-prototype" experimental fleet that had been operated in California in Ford vehicle test programs. Each of the vehicles in these fleets was tested by the FTP, the Federal Short Cycle, and the Federal 3-Mode. Two different statistical analysis methods were used to assess "correlation" -- a conventional correlation analysis, and a contingency table analysis. This work is a continuation of that activity reported in Report No. EPA-460/3-76-010a. PB 274 559.

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VOLUME II

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Ann Arbor, Michigan 48105

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Publication No. EPA-460/3-76-010b

FOREWORD

This report, prepared by The Aerospace Corporation for the U. S. Environmental Protection Agency, Emission Control Technology Division, presents the results of a statistical analysis of the degree of correlation between two short vehicle emission tests, and the 1975 Federal Test Procedure. As Volume II, it contains the results of the second phase of analysis activity originally reported in EPA-460/3-76-010a, "Short Test Correlation Analyses on 300, 1975 Model Year Cars, Volume I," hereinafter referred to as "Volume I."

The correlation analysis results reported in Volume I were based on experimental test data from 300, 1975 model year vehicles, composed of three groups of 100 vehicles each that were tested in the cities of Chicago, Houston, and Phoenix for EPA's Fiscal Year 1974 Emission Factor Program. Volume II extends Volume I results in the following areas.

1. Similar correlation analyses for 117, 1975 model year vehicles tested in the city of Denver for the FY 1974 Emission Factor Program, to ascertain the effects of high altitude.

2. Extended analyses of data from all four cities to determine the sensitivity of short test/FTP correlations and the emission reductions resulting from the application of various approaches to defining short test pass/fail cut-points and computer simulated inspection/maintenance programs.

3. Correlation analyses of short test data acquired from a 144, 1974 model year vehicle fleet and a 40-vehicle, catalyst-equipped experimental fleet as reported in EPA-460/3-76-011.*

4. Analyses which estimate the standard errors of short test pass/fail cut-points and of the contingency table parameters.

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*"Federal Test Procedure and Short Test Correlation Analyses," Report No. EPA-460/3-76-011, The Aerospace Corporation, El Segundo, California, April 1976

Volume I sets forth in detail the various statistical tools used in the correlation analyses. In the interest of brevity, they are not repeated in Volume II; however, the reader is referred to the appropriate section of Volume I when relevant.

The Volume II study results are presented in five sections. A concise review of important findings and conclusions is presented in Section 1. Section 2 contains the results of short test/FTP correlation analyses of the 117-vehicle Denver fleet. The extended analyses of data from all four cities are contained in Section 3. Section 4 presents the short test correlation results for the 1974 model year fleet, and Section 5 summarizes the results of the short test variability analyses.

Because of the numerical analysis nature of the study and the many variables addressed, the basic results of the study are contained in many tables which are contained in an Appendix of tables. Only Section 1 (the Summary) has tabular data integrated with the text.

ACKNOWLEDGMENT

Dr. John C. Thacker was principally responsible for the statistical analysis effort reported herein. The following technical personnel of The Aerospace Corporation also made valuable contributions to the analyses performed under this contract: S. Cheung, F. Meyer, and D. K. Sakaguchi.

Ms. Janet Becker of the Environmental Protection Agency's Emission Control Technology Division served as EPA Project Officer for this study.

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Conservation Division

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1. SUMMARY

Statistical analyses have been performed to determine the degree of "correlation" between vehicle emissions as measured by two specific short tests (STs) and vehicle emissions as measured by the Federal Emission Certification Test Procedure (FTP) for new vehicles. The availability of a short test which shows "reasonable correlation" with the FTP is requisite to the promulgation of regulations that impose the in-use warranty provisions of Sec. 207(b) of the Clean Air Act of 1970 upon the motor vehicle manufacturers.

The analyses were based upon ST and FTP test data, which were obtained from the Environmental Protection Agency, on the following four groups of vehicles.

1. Three 100-vehicle 1975 model year fleets tested in Chicago, Illinois; Houston, Texas; and Phoenix, Arizona for the FY 74 Emission Factor Program
2. A 117-vehicle 1975 model year fleet tested in Denver, Colorado for the FY 74 Emission Factor Program
3. A 144-vehicle 1974 model year fleet tested in the greater Detroit, Michigan area
4. A 40-vehicle catalyst-equipped "1975-prototype" experimental fleet that had been operated in California in Ford vehicle test programs

Each of the vehicles in these fleets was tested for emissions, using the FTP and the following STs:

Federal Short Cycle
Federal Three-mode

The first of these STs is a CVS (constant volume sampling) or bag-type test wherein a test technician drives the car on the dynamometer in accordance with a prescribed driving pattern. The vehicle exhaust is diluted by the CVS procedure, and a single sample bag of diluted exhaust is collected for the ST. The Federal Three-mode is a steady-state test, as opposed to a test with a driving cycle. In this test, the test technician operates the vehicle on a dynamometer at two fixed vehicle speeds and dynamometer loads, and at idle. The vehicle tailpipe exhaust is sampled directly, and the concentration of each pollutant is measured and recorded. The Federal Three-mode ST has high-speed, low-speed, and idle modes. The idle mode can be conducted in two ways: (1) idle with transmission in drive (automatic transmission only), or (2) idle in neutral (automatic and manual transmissions).

Hydrocarbon (HC) and carbon monoxide (CO) measurements were recorded with garage-type instruments for the Federal Three-mode ST. All oxides of nitrogen (NO_x) measurements were made with laboratory analyzers.

Two different statistical analysis methods were used to assess "correlation" -- the conventional Pearson correlation coefficient was used as a quantitative measure, and a conventional contingency table approach was used for qualitative measure.

The correlation analysis results for vehicle groups 3 and 4 were reported in April 1976 in Report No. EPA-460/3-76-011, "Federal Test Procedure and Short Test Correlation Analyses." Similar results for vehicle group 1 were reported in October 1976 in Report No. EPA-460/3-76-010a, "Short Test Correlation Analyses on 300, 1975 Model Year Cars, Volume I," hereinafter referred to as "Volume I."

This volume (Volume II) contains the results of the second phase of the Volume I analysis activity. It extends the Volume I results in the following areas.

1. Correlation analyses for the 117, 1975 model year vehicles tested in the city of Denver (group 2), to ascertain the effects of high altitude

2. Extended analyses of data on 1975 model year vehicles tested in all four cities (groups 1 and 2) to determine the sensitivity of short test/FTP correlations and of emission reductions resulting from the application of various approaches to defining short test pass/fail cut-points and of computer simulated inspection/maintenance programs

3. Extensions of the correlation analyses performed on the data for vehicle groups 3 and 4 as reported in Report No. EPA-460/3-76-011. These analyses were performed to assess the sensitivity of the correlations to FTP variability

4. Estimation of the standard error of the short test pass/fail cut-point and of the contingency table parameters

The principal results of the study are briefly summarized below for each of the above four areas. More detailed results are contained in Sections 2 through 5 and in the Appendix.

1.1 SHORT TEST CORRELATION ANALYSES ON DENVER VEHICLES

1.1.1 Conventional Correlation Analyses

A conventional correlation analysis was performed on the Denver 117-vehicle 1975 model year fleet for both the Federal Short Cycle vs. the FTP, and the Federal Three-mode vs. the FTP. The Pearson correlation coefficient was used as a measure of quantitative relatability of short test (ST) emission results and the Federal Test Procedure (FTP) results. The closer the coefficient is to one in absolute value, the stronger the relationship. The closer the coefficient is to zero, the weaker the relationship. A negative coefficient indicates an inverse relation between the observed test results; i.e., a low ST reading corresponds to a high FTP reading and a high ST reading corresponds to a low FTP reading.

1.1.1.1 Short Test (ST) Comparison

A comparison of the Federal Short Cycle results with the better[*] modes of the Federal Three-mode ST is shown in Table 1-1 for the Denver fleet and the pooled fleet of 300 vehicles in Chicago, Houston, and Phoenix.

The Federal Short Cycle exhibited better FTP tracking characteristics (higher correlation coefficients) than the Federal Three-mode for all three pollutants (HC, CO, and NO_x).[**] For the Federal Three-mode ST, the idle test mode in neutral (both automatic and manual transmissions) and drive (automatic transmission only) was better than the high- and low-speed test modes for tracking HC and CO. The high- and low-speed modes were best for NO_x discrimination, and were not significantly different.

A comparison of the Federal Short Cycle/FTP correlation coefficients for HC, CO, and NO_x in Denver (0.81, 0.86, 0.88, respectively) and in the other three cities (0.78, 0.89, 0.81, respectively) indicates only slight differences. Although there are significant differences in average FTP emission levels between Denver and the other three cities, the correlation between the Federal Short Cycle ST and the FTP is apparently altitude-invariant.

Federal Three-mode/FTP correlation for CO appears to be altitude-invariant. Although NO_x correlation seems to be dependent on altitude, this may be attributable to the variable humidity conditions which occurred while testing in the four cities (note that the Federal Three-mode test procedure did not contain a humidity correction procedure). For example, the high- and low-speed NO_x correlation coefficients in Phoenix, with its less variable humidity, were computed to be 0.73 and 0.66, respectively. These values compare more closely with Denver than do the

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[*] "Better" is defined as those modes which produce the highest Pearson correlations with the FTP.

[**] HC = hydrocarbons; CO = carbon monoxide; NO_x = oxides of nitrogen

Table 1-1. Comparison of ST Correlation Coefficients for High Altitude and Low Altitude Locales

	Short Test	ST/FTP Pearson Correlation Coefficient		
		HC	CO	NO_x
117 Denver Vehicles (High Altitude)	Federal Short Cycle	0.81	0.86	0.88
	Federal Three-mode	0.74(a)	0.62(a)	0.64(c)
		0.31(b)	0.65(b)	0.70(d)
Pooled Fleet of 300 Vehicles (Low Altitude)	Federal Short Cycle	0.78	0.89	0.81
	Federal Three-mode	0.58(a)	0.67(a)	0.52(c)
		0.45(b)	0.69(b)	0.48(d)

(a) Idle-in-drive test mode

(b) Idle-in-neutral test mode

(c) High-speed test mode

(d) Low-speed test mode

pooled three cities results. Although the numerical results are somewhat different, the trend for HC correlation is higher on the idle-in-drive mode than on the idle-in-neutral mode. However, the values of the correlation coefficients are more variable in both the high- and low-altitude data.

In summary, the Pearson correlations between FTP and ST levels for high-altitude locales appear to be no higher than those for low-altitude locales; however, there is a higher degree of variability in the Federal Three-mode correlation coefficients than in the Federal Short Cycle correlation coefficients.

The Pearson correlation coefficient is a quantitative measure of the linear association between ST and FTP values. For the promulgation of Section 207(b) of the Clean Air Act, it is not so important that the ST reading predict the FTP reading as it is that the failure or passage of the ST accurately reflect failure and passage of the FTP. The degree of ST/FTP correlation in this latter sense is investigated by applying the contingency table approach.

1.1.2 Contingency Table Analysis

The contingency table is defined in Table 1-2, along with its associated parameters. A pictorial demonstration of its application to a given data set (ST values and FTP values) is shown in Figure 1-1. Of interest is the degree of ST/FTP correlation as evidenced by the percentage of PPs and FFs that result when vehicles are subjected to a predetermined set of short test pass/fail cut-points. For a given data set, the degree of correlation that exists depends largely on the criterion used to select the ST pass/fail cut-points. For the analysis presented in Volume I, the bounded errors of commission method at the 5% level was used exclusively to set cut-points. In this method, the ST cut-points are selected to minimize E_o while holding the E_c below a specified level. This method is illustrated in Figure 1-2. A given permissible level of E_c will establish the level of E_o that will occur. Since each E_o represents a lost opportunity to improve air quality, the estimation of this loss in quantitative terms is important when trying to evaluate the acceptability of the given E_c level.

Table 1-2. Contingency Table

		True = FTP		
		Pass	Fail	Total
Predictor = Short Test	Pass	a	b	a + b
	Fail	c	d	c + d
	Total	a + c	b + d	n = a + b + c + d

a = number of correctly passed vehicles (PP)
b = number of errors of omission (E_o)
c = number of errors of commission (E_c)
d = number of correctly failed vehicles (FF)

Sensitivity = a/(a + c)
Specificity = b/(b + d)
False positive error = b/(a + b)
False negative error = c/(c + d)

$$\text{Correlation index} = \frac{ad - bc}{\left[(a + b)(a + c)(b + d)(c + d)\right]^{1/2}}$$

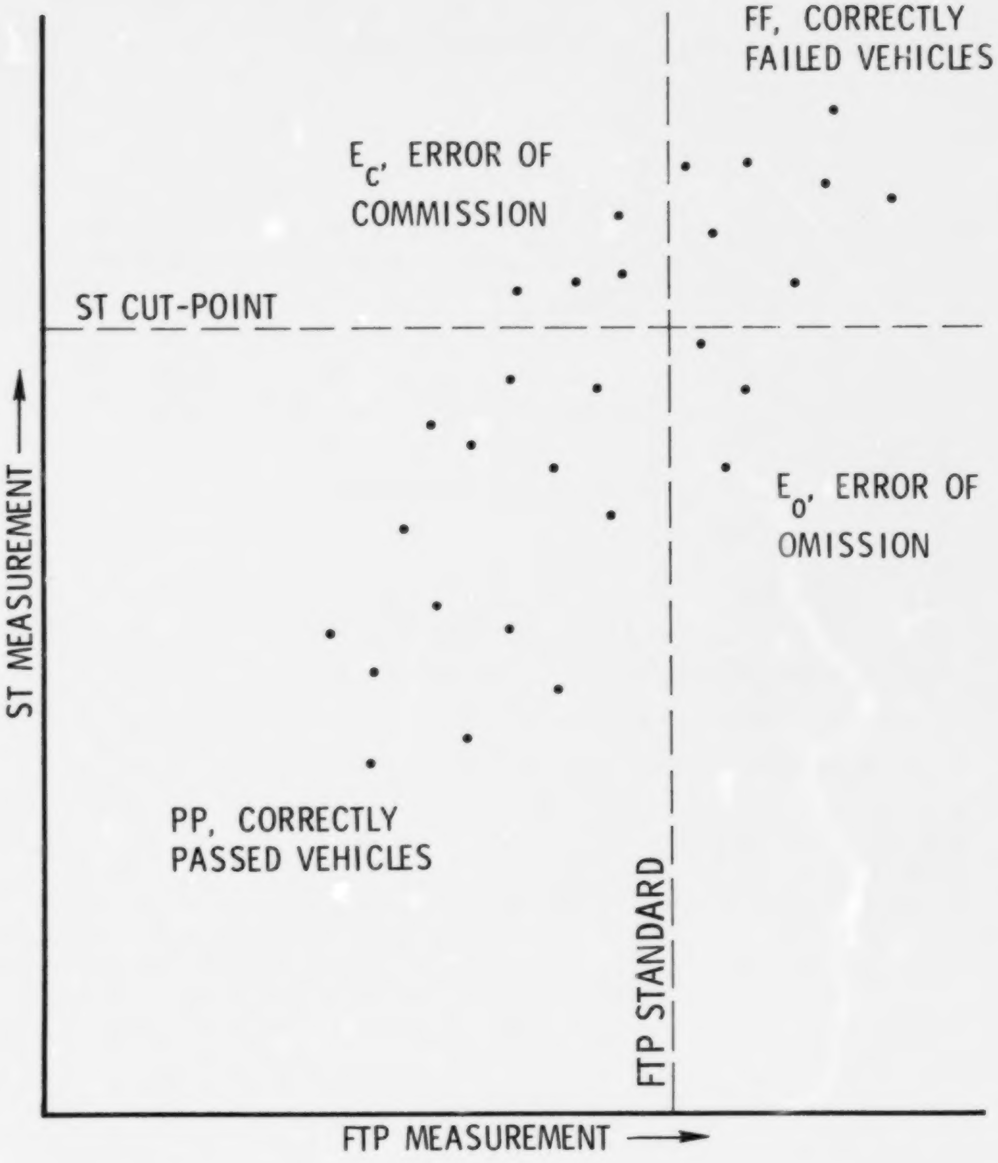
FF, CORRECTLY FAILED VEHICLES
E_c, ERROR OF COMMISSION
ST CUT-POINT
ST MEASUREMENT →
E_o, ERROR OF OMISSION
PP, CORRECTLY PASSED VEHICLES
FTP STANDARD
FTP MEASUREMENT →

Figure 1-1. Contingency Table Representation

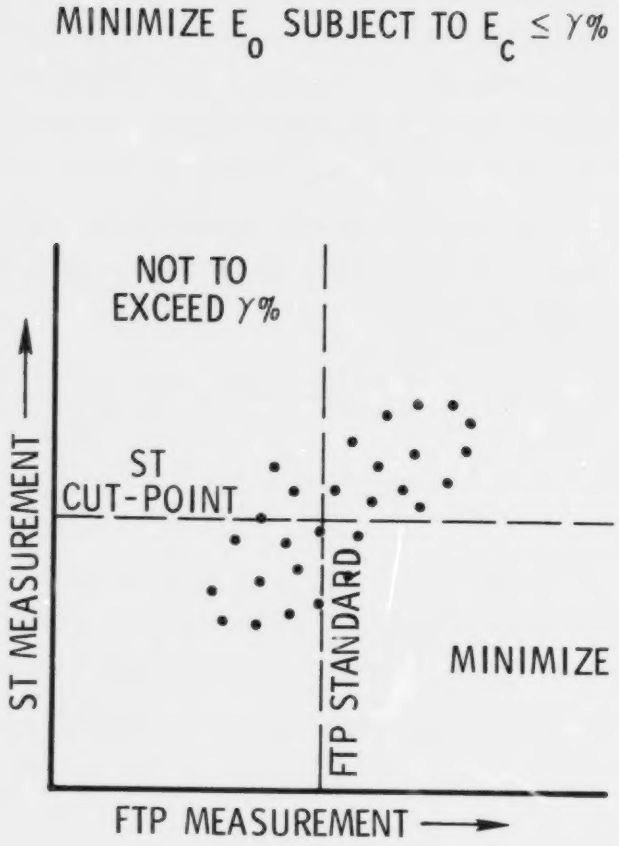
MINIMIZE E_0 SUBJECT TO $E_C \leq \gamma\%$
NOT TO EXCEED γ%
ST CUT-POINT
MINIMIZE
FTP STANDARD
ST MEASUREMENT →
FTP MEASUREMENT →

Figure 1-2. Bounded Errors of Commission Method

With regard to procedural technique, a bivariate normal or log-normal distribution model (depending on which model best fit the data) was fitted to a particular pollutant's data set by incorporating the ST/FTP correlation coefficient for the pollutant mean ST and FTP values for the pollutant, and standard deviations of ST and FTP values for the pollutant. The ST cut-points were then determined by using analytical equations derived from the model for the predicted population of the vehicle fleet. Non-parametric methods were also employed to validate this procedure.

Also determined in the contingency table analysis were the short test "effectiveness" (STE) and the short test "rejection ratio" (STRR). ST effectiveness is defined as

$$\text{ST effectiveness} = \text{STE} = \frac{\text{Number of FF vehicles}}{\text{Number of FTP failing vehicles}} \tag{1-1}$$

$$= \frac{FF}{FF + E_o}$$

Thus, on this basis, the ST is less effective than the FTP in proportion to the percent of errors of omission (E_o) which occur, and the STE value is a relative measure of air quality improvement due to a particular ST.

The short test rejection ration is defined as

$$\text{STRR} = \frac{E_c + FF}{E_o + FF} \tag{1-2}$$

The denominator of this ratio ($E_o + FF$) represents the number of vehicles actually failing the FTP. The numerator ($E_c + FF$) represents the number of vehicles failing the short test. Whereas the STE value is a relative measure of air quality improvement, the STRR value includes a joint consideration of E_c and E_o vehicles and can be considered a relative measure of the "fairness" of the ST to the vehicle manufacturer or vehicle size or class. Only when the STRR value exceeds one would a manufacturer be required to implement warranty procedures on a greater number of vehicles than he should have, based upon the observed FTP failure rate.

Table 1-3. Comparison of ST Contingency Table Values for STE and STRR (E_c Set at 5 Percent for Pooled Fleet)

	Short Test	Parameter							
		HC		CO		NO_x		Multiple Constituents[(a)]	
		STE	STRR	STE	STRR	STE	STRR	STE	STRR
117 Denver Vehicles (High Altitude)	Federal Short Cycle	0.78	0.85	0.98	1.03	0.74	1.62	0.97	1.04
	Federal Three-mode								
	High-speed Mode	--	--	--	--	0.41	1.29	--	--
	Low-speed Mode	--	--	--	--	0.41	1.30	--	--
	Idle in Drive	0.49	0.56	0.89	0.95	--	--	0.83	0.87
	Idle in Neutral	0.54	0.61	0.91	0.95	--	--	0.81	0.83
	Combination of Best Modes[(b)]	--	--	--	--	--	--	0.89	0.90
Pooled Fleet of 300 Vehicles (Low Altitude)	Federal Short Cycle	0.589	0.748	0.690	0.783	0.604	0.840	0.821	0.928
	Federal Three-mode								
	High-speed Mode	--	--	--	--	0.310	0.547	--	--
	Low-speed Mode	--	--	--	--	0.301	0.538	--	--
	Idle in Drive	0.375	0.533	0.562	0.652	--	--	0.704	0.801
	Idle in Neutral	0.338	0.495	0.524	0.614	--	--	0.597	0.669
	Combination of Best Modes[(b)]	--	--	--	--	--	--	0.663	0.729

[(a)] Car fails the ST if any of its HC, CO, or NO_x measurements exceed the cut-points for each pollutant.

[(b)] Combination of best individual test modes (idle-in-drive for HC and CO, high-speed for NO_x).

Since FF, E_c, and E_o vary with the value of the ST cut-point, STE and STRR depend upon the ST cut-point and can therefore be used to establish the values of ST cut-points.

1.1.2.1 Short Test Comparison at $E_c = 5\%$

A comparison of the Federal Short Cycle results and the better modes of the Federal Three-mode ST is shown in Table 1-3 for the Denver fleet and the pooled fleet of 300 vehicles in Chicago, Houston, and Phoenix.

For both fleets, the Federal Short Cycle exhibited higher STE values than the Federal Three-mode for all three pollutants (HC, CO, and NO_x). However, in the case of CO, which was the dominant failure mode on the FTP for both the Denver fleet and the 300-vehicle fleet, the idle test mode STE value was reasonably close to the Federal Short Cycle value. Further, when considering the idle mode in drive as a multiple-constituent test (i.e., a car fails the ST if any one of its HC, CO, or NO_x measurements exceeds the respective idle test cut-point for each pollutant), then the idle mode STE value is reasonably close to the Federal Short Cycle value. The idle-in-neutral test mode, although not quite as effective as the idle-in-drive mode, would be required for those cars with manual transmissions.

In the case of the Federal Short Cycle ST, the STE values for HC, CO, NO_x, and the multiple-constituent test are approximately 50, 50, 23, and 18 percent higher, respectively, in Denver than in the pooled fleets of the other three cities. For the Federal Three-mode ST, the STE values are approximately 40, 60, 32, and 36 percent higher in Denver than in the other three cities for HC, CO, NO_x, and the multiple-constituent tests. For HC and CO, this is a direct result of positive ST/FTP correlation and of the FTP standards (1.5 grams/mile HC and 15.0 grams/mile CO), being substantially lower than the average Denver vehicle's emissions (2.28 grams/mile HC and 48.6 grams/mile CO). The increased NO_x STE may be attributable to small variations in relative humidity.

Table 1-4 shows the variation of STE values achieved in the four cities in which the four groups of 1975 model year vehicles were tested. The most notable difference is the Federal Three-mode NO_x STE value in Phoenix, which is approximately twice that of Chicago and Houston. The humidity in Phoenix is considerably lower and more consistent in level than in these two cities. The NO_x correction factor for humidity was included in the Federal Short Cycle and the FTP testing procedures, but was not included in the Federal Three-mode testing procedure. This accounts for the relative uniformity of NO_x correlation existing for the Federal Short Cycle in all four cities and the non-uniformity of the Federal Three-mode results. If the NO_x humidity correction factor had been applied, the Chicago and Houston results would probably be similar to the results obtained in Phoenix and Denver.

The STRR values show a trend similar to that of the STE values when Denver results and three-cities results are compared.

With regard to the short test rejection ratio, the STE values of Table 1-3 for the pooled fleet of 300 vehicles (using $E_c = 5\%$ as the cut-point selection technique) were achieved without exceeding an STRR value of one in any case; i.e., the total number of vehicles failed by the ST (E_c + FF) did not exceed the number of vehicles actually failing the FTP (E_o + FF). Thus, by selecting cut-points at $E_c = 5\%$, and based on the emission characteristics of the pooled 300-vehicle fleet, the auto manufacturers would not have been subjected to an unreasonable warranty liability, in terms of total number of vehicles rejected. In the case of the Denver fleet, however, the STRR value of one was slightly exceeded (1.03 to 1.04) for CO and multiple-constituent tests with the Federal Short Cycle, and considerably exceeded (1.29 to 1.62) for NO_x on both the Federal Short Cycle and the Federal Three-mode.

The high STRR values for NO_x in Denver are the result of positive ST/FTP correlation and the low percentage (5.5%) of FTP failures. Since the cut-point has been established to yield E_c equaling 5%, the ratio

Table 1-4. Comparison of STE Values for Four Cities Based Upon ST Cut-Points Established at $E_c = 5\%$

	Short Test Effectiveness (STE)											
	Chicago			Houston			Phoenix			Denver		
	HC	CO	NO_x	HC	CO	NO_x	HC	CO	NO_x	HC	CO	NO_x
Federal Short Cycle	0.554	0.664	0.618	0.691	0.731	0.562	0.530	0.676	0.645	0.78	0.98	0.74
Federal Three-mode												
High Speed	-	-	0.204	-	-	0.249	-	-	0.535	-	-	0.41
Low Speed	-	-	0.177	-	-	0.291	-	-	0.471	-	-	0.41
Idle in Drive	0.405	0.539	-	0.360	0.584	-	0.349	0.551	-	0.49	0.89	-
Idle in Neutral	0.352	0.509	-	0.348	0.536	-	0.296	0.517	-	0.54	0.91	-

of E_c + FF to FTP failures is bounded between 0.91 and 1.91. Positive ST/FTP correlation will yield a relatively high proportion of FF vehicles from the available FTP failures which will result in a value of STRR well above its minimum.

The above findings are restricted solely to the case of overall fleet averages. Because the makeup of the 300-vehicle and 117-vehicle test fleets represented a cross-section of the 1975 model year in-use population, the test fleets included the many variables of manufacturer, vehicle size (inertia test weight), engine size (displacement), emission control system type, transmission type, and fuel system type. Based on the results reported in Volume I, it would be expected that individual findings for each of these sub-groups of the total fleet would vary somewhat from those for the overall fleet.

1.2 EXTENDED ANALYSES OF FOUR CITIES DATA

Extended analyses were made using the three cities data from Volume I plus the Denver data. These analyses were made to determine the sensitivity of correlations and emission reductions resulting from various short test cut-point selection methods.

1.2.1 Cut-point Selection Methodology

In Volume I, the ST cut-points were selected on the basis of a given E_c rate (E_c = 5%) when performing contingency table analyses. In selecting multiple cut-points based on a given E_c rate, however, the resulting values of STE and STRR are still dependent upon the characteristics of the fleet data set and are subject to variation which is beyond the control of this cut-point selection technique. For example, if it were desired to achieve an STE value of 0.7, then it would seem more preferable to select ST cut-points on this basis, rather than by E_c value; likewise, if an STRR value of 1.0 were desired.

In order to assess the properties of alternative cut-point selection techniques, three new selection techniques were introduced:

fixed STRR, fixed STE, and fixed ratio of E_c to $(E_c + FF)$. Contingency table analyses were performed using ST cut-points selected by these techniques, as well as fixed E_c rate for the purpose of comparative analysis. Computer simulations of a 207(b) program, implemented using the cut-points as determined by the various techniques, were conducted for the purpose of comparing the impact of the cut-point selection technique upon air quality benefit.

The technique "STRR = 1.0" is equivalent to selecting the cut-point such that the number of ST failures equals the number of FTP failures:

$$E_c + FF = FF + E_o$$

$$(\text{ST failures}) = (\text{FTP failures})$$

The technique "$E_c/(E_c + FF) = \text{constant}$" is equivalent to controlling the distribution of E_c and FF vehicles failed by the ST. Constant values of 0.1 and 0.2 were used.

The technique "STE = constant" is equivalent to controlling the FF vehicles as a fixed percentage of the FTP failures:

$$FF = \text{constant}\ (E_o + FF)$$

Constant values of 0.6, 0.7, and 0.8 were examined.

1.2.2 Contingency Table Analysis Results

Figures 1-3 through 1-5 illustrate respectively the variation of the cut-point parameters for HC, CO, and NO_x using the better modes of the Federal Three-mode ST for the 300-car pooled fleet. The results for the Federal Short Cycle and the Denver fleet are similar in nature.

Each figure relates the variation of STRR, STE, E_c, and $E_c/(E_c + FF)$ to the specific cut-point techniques noted above (STRR = 1.0,

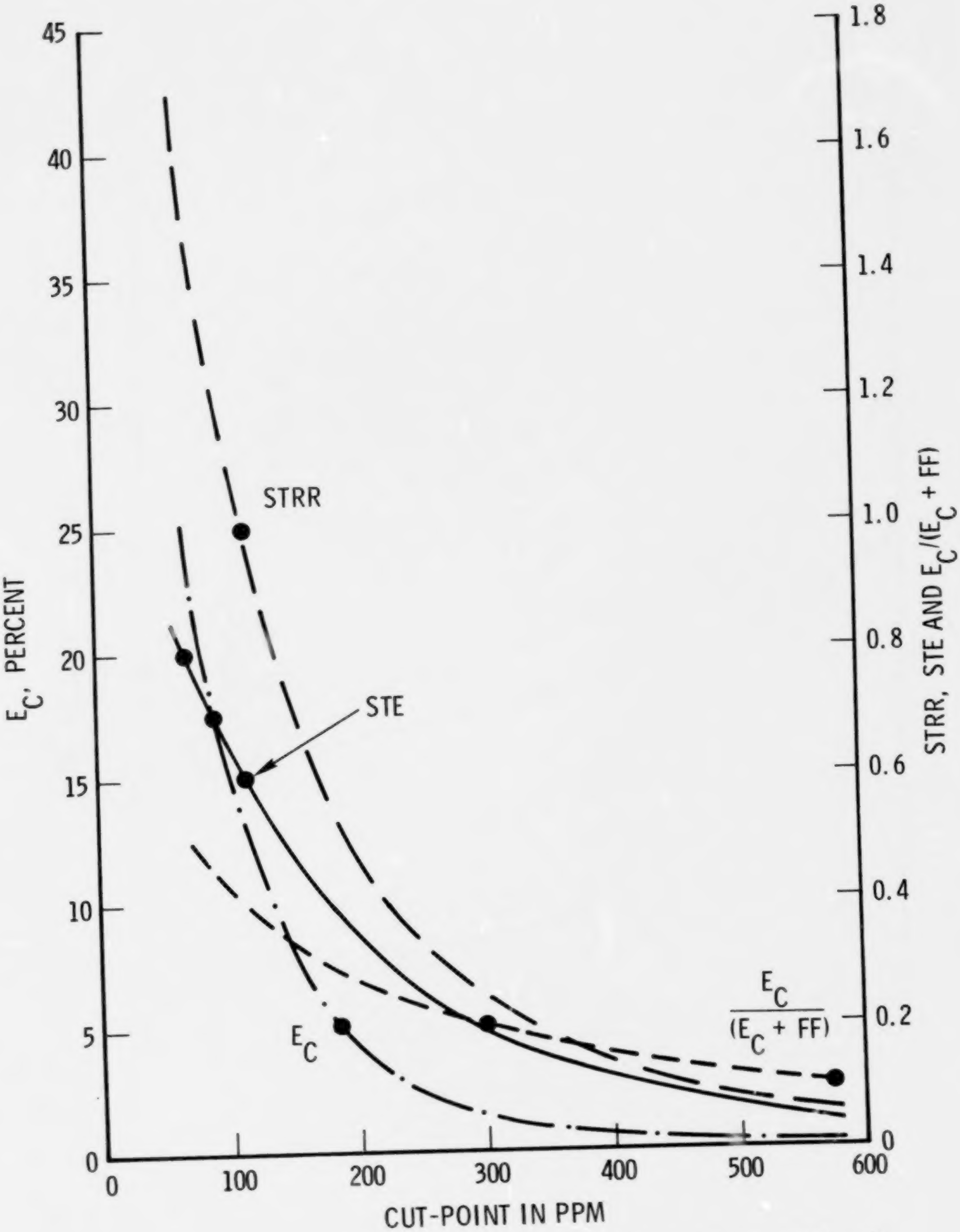

Figure 1-3. Variation of Selected Parameters With HC Cut-Point; 300 Car Fleet; Federal Three-Mode ST; Idle in Drive Mode

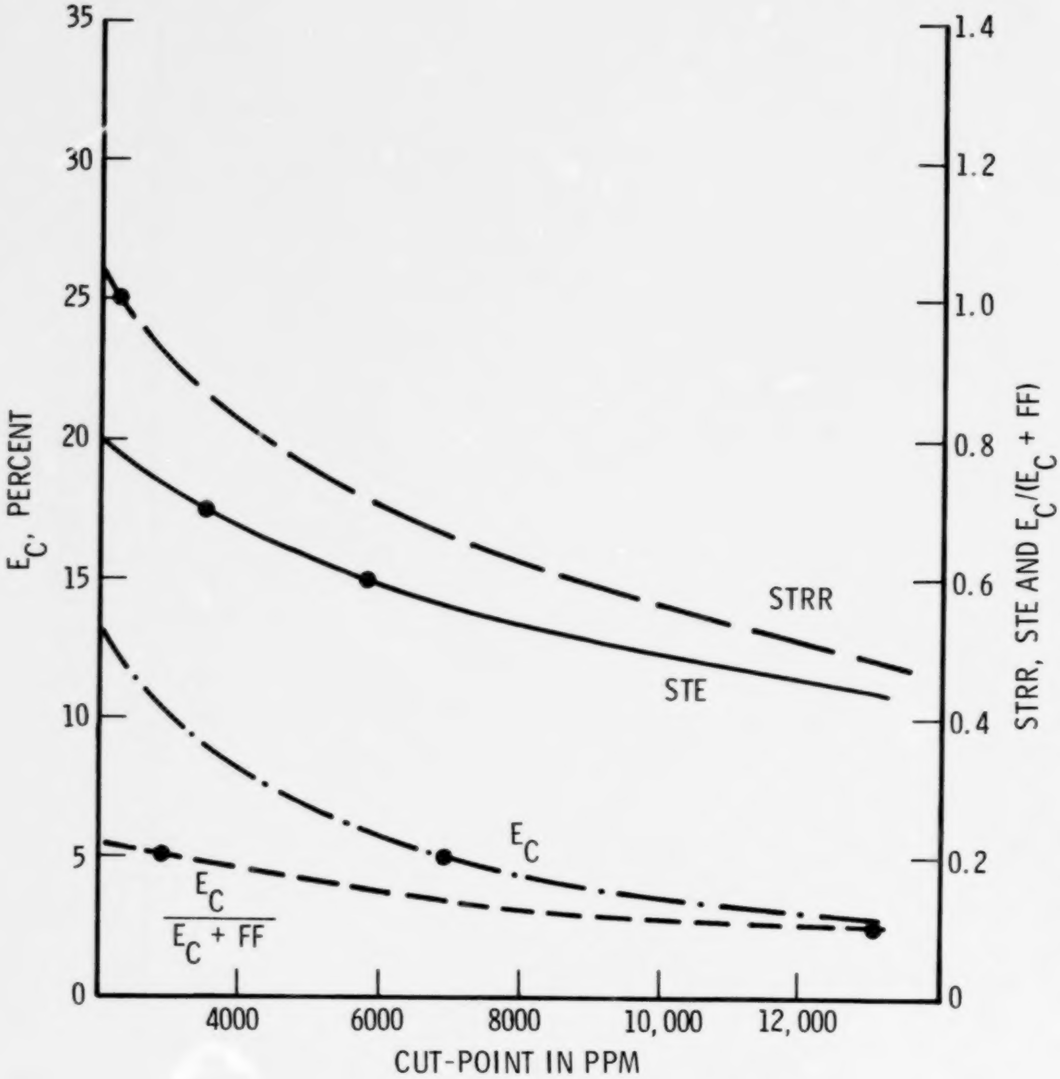

Figure 1-4. Variation of Selected Parameters With CO Cut-Point; 300 Car Fleet; Federal Three-Mode ST; Idle in Drive Mode

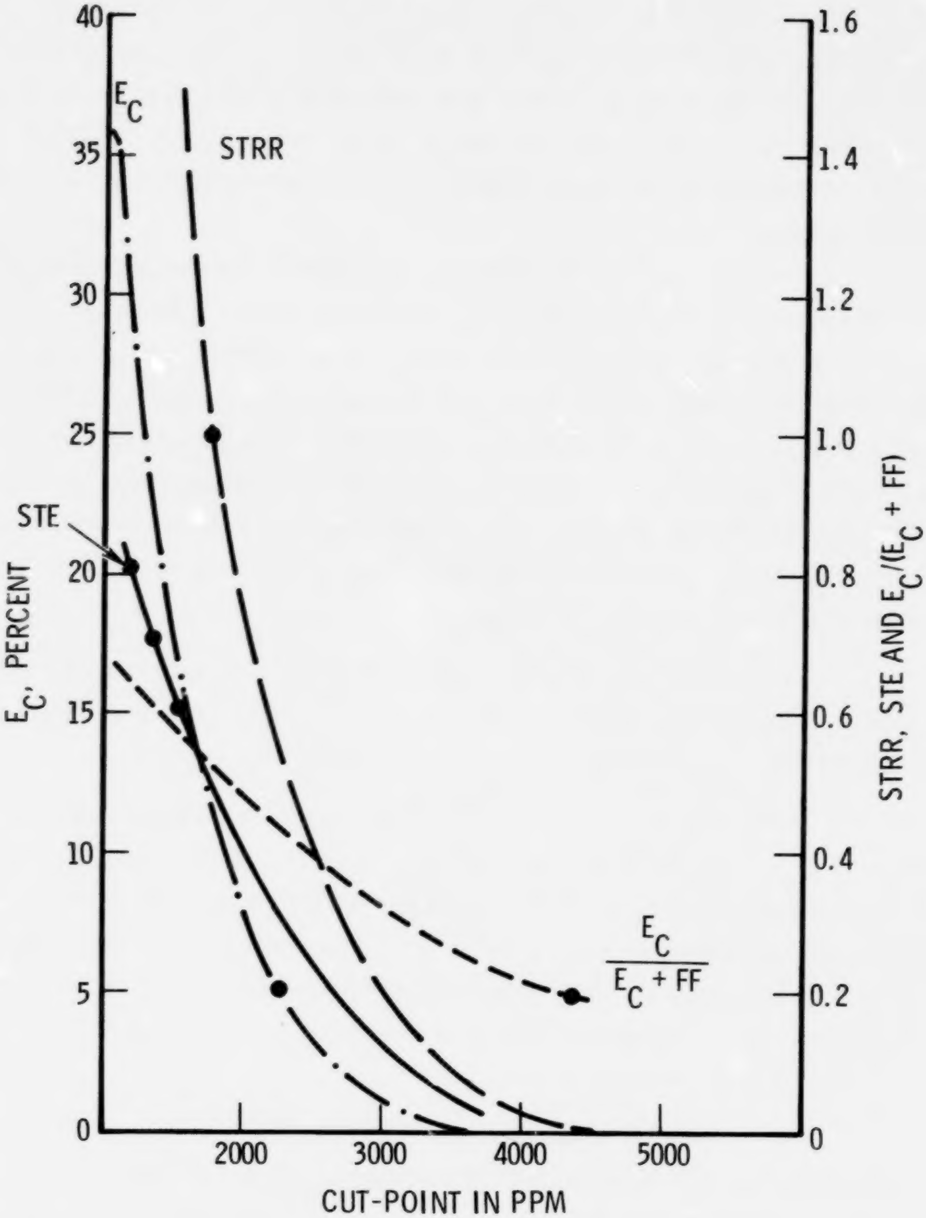

Figure 1-5. Variation of Selected Parameters With NO_x Cut-Point; 300 Car Fleet; Federal Three-Mode ST; High-Speed Mode

E_c = 5%, $E_c/(E_c + FF)$ = 0.1 and 0.2, and STE = 0.6, 0.7, and 0.8). Each technique is delineated by black circles on the figures. As can be seen, for each pollutant test, there is no consistent variation of the results of the techniques STRR = 1.0, E_c = 5%, $E_c/(E_c + FF)$ = 0.1 or 0.2, and STE = 0.6, 0.7, or 0.8. Of these techniques, STRR = 1.0 consistently produces the highest STE values.

It would appear desirable to use the STRR parameter as the basis for selecting the ST cut-points for each pollutant. The other parameters are then uniquely determined for each vehicle test group and pollutant. The remaining policy decision would be the value of STRR to use in cut-point determination. Although a value of 1.0 was used in the present analysis, values less than 1.0 could be used as well, depending upon the needs of the inspection program to be implemented. Table 1-5 summarizes the significant values of the cut-point parameters for both test fleets and both STs at STRR = 1.0 for each pollutant.

The multiple-constituent test results are shown in Figure 1-6 for the Federal Three-mode idle-in-drive mode. This figure relates the variation of STRR, E_c, and $E_c/(E_c + FF)$ to STE.

It should be noted that in a multiple-constituent test (i.e., where the car fails the ST if any one of its HC, CO, or NO_x measurements exceeds the respective cut-point for each pollutant), the utilization of STRR = 1.0 for cut-point selection for each individual pollutant results in an overall STRR value greater than one, as shown in Figure 1-6. On this basis, then, individual pollutant cut-points should be based on STRR < 1 if the overall STRR value is not to exceed 1.

Of course, if the principal policy concern were to limit the number of errors of commission, then setting E_c equal to the desired maximum rate would be the appropriate cut-point selection technique. Also, E_c rate could be combined with STRR rate. For example, the ST cut-point could be based on E_c = constant (e.g., 15%) unless STRR exceeded 1.0, in which case it would be based on STRR = 1.0.

Table 1-5. Contingency Table Parameters for Pollutant Cut-Points Established at STRR = 1.0

	Emission Parameter											
	HC			CO			NO_x			Multiple Constituents		
	STE	E_c	$\frac{E_c}{E_c+FF}$	STE	E_c	$\frac{E_c}{E_c+FF}$	STE	E_c	$\frac{E_c}{E_c+FF}$	STE	E_c	$\frac{E_c}{E_c+FF}$
300-Car Fleet												
Federal Short Cycle	0.72	9.01	0.28	0.82	9.75	0.18	0.67	6.9	0.33	0.87	9.0	0.14
Federal Three-mode												
High Speed	-	-	-	-	-	-	0.48	11.0	0.52	-	-	-
Idle in Drive	0.60	12.8	0.40	0.78	12.5	0.22	-	-	-	0.80	14.0	0.20
Denver Fleet												
Federal Short Cycle	0.87	8.6	0.13	0.96	4.0	0.04	0.58	2.5	0.41	0.95	4.5	0.05
Federal Three-mode												
High Speed	-	-	-	-	-	-	0.35	3.7	0.60	-	-	-
Idle in Drive	0.79	14.0	0.21	0.93	6.0	0.07	-	-	-	0.93	6.2	0.07

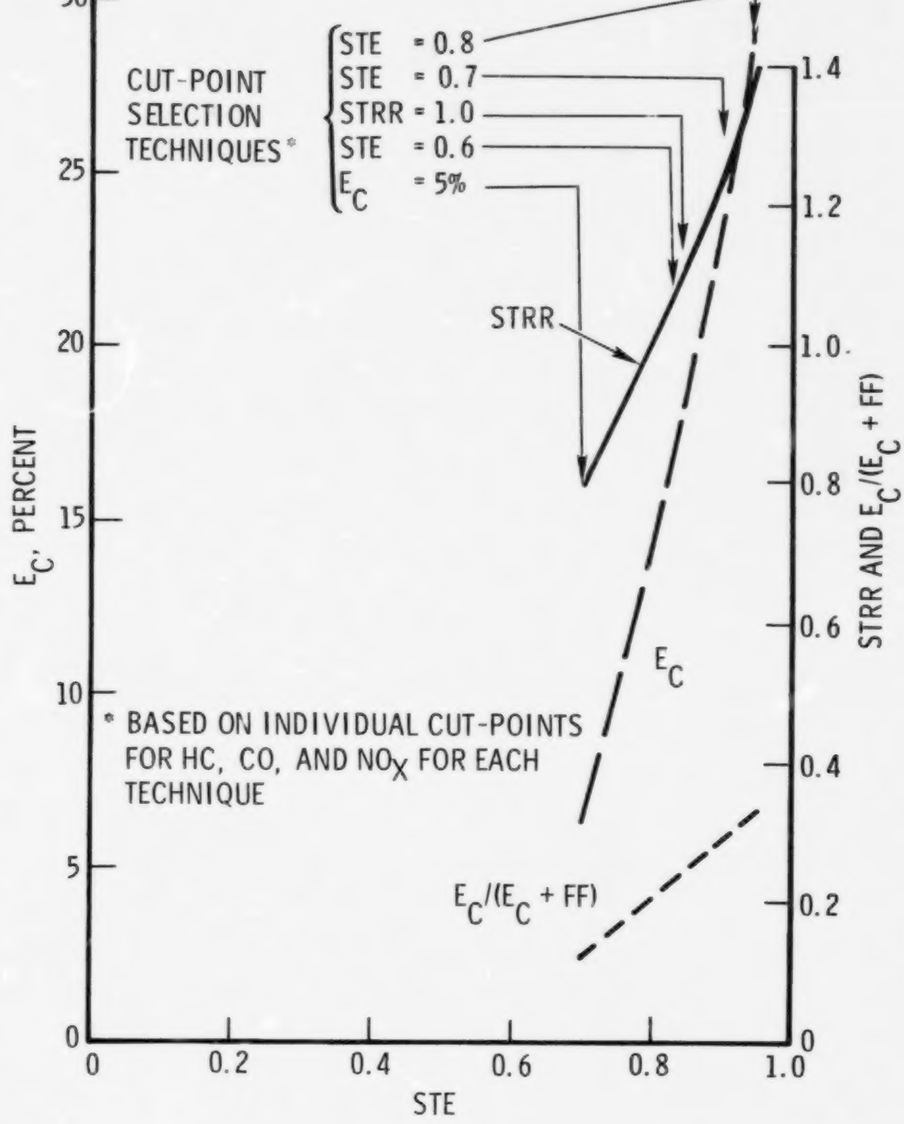

Figure 1-6. Variation of Selected Parameters With STE on Multiple Constituents Test; 300 Car Fleet; Federal Three-Mode ST; Idle in Drive Mode

1.2.3 207(b) Implementation: Computer Simulation Analyses

A computer program was developed to simulate the implementation of a 207(b) program on a specific fleet of vehicles, the "controlled fleet," and to compare the emission results with an uncontrolled fleet (originally identical to the controlled fleet) whose emissions deteriorate without the influence of a mandatory 207(b) program. The comparison was made over a 50,000-mile period for each fleet, and the air quality benefit due to the 207(b) program was assessed annually.

Existing 300-car and 117-car fleet data were used to establish a distribution model for the emission values of the three regulated pollutants at the mean mileage for each displacement group for each fleet. This distribution model was then used to stochastically generate the two identical fleets of vehicles with statistical attributes similar to the 300-car and 117-car data sets. The two simulated fleets were each divided into three mutually exclusive groups based upon engine displacement: 150 CID and less; 151 to 259 CID; and 260 CID and greater.

The existing 300-car and 117-car data sets were also used to establish the ST inspection pass-fail levels. Two methodologies in selecting the levels were examined. The first method, designated the "207(b) approach," established pass-fail levels for each engine displacement group and for each pollutant, using the cut-point selection techniques described in Section 1.2.1. The second method, designated the "I/M approach," established for each pollutant a single pass-fail level which applied to all engine displacement groups.

Because of uncertainties in the areas of deterioration rates and maintenance effectiveness, a limited sensitivity analysis was performed by using several different maintenance models and by varying many of the program input parameters. This provided insight into the variability of estimated air quality benefit and identified the most sensitive components of the analysis program.

A maintenance policy was selected for each vehicle individually. If the vehicle was classified by the ST as an E_c or FF vehicle, the FTP emission rates were adjusted to reflect the effect of corrective maintenance. If the vehicle was classified as a PP or E_o vehicle, the FTP emission rates were left undisturbed. Three methods of adjusting the FTP values were investigated, as discussed below.

a) Version 1: Proportionally Coupled with Lower Bounds
For HC and CO, a pollutant passing the FTP is reduced by the same proportion as a pollutant failing the FTP. The lower limit of any reduction, beyond the FTP standard, is one-half the FTP standard. NO_x is unaffected by HC and CO maintenance, and in the event of maintenance, is adjusted to the FTP standard.

b) Version 2: Independent Maintenance to FTP Standard
Each pollutant is adjusted independently of the values of the other pollutants. Failing pollutants are adjusted to the respective FTP standard.

c) Version 3: Independent Maintenance to Equivalent ST Standard
Each pollutant is adjusted independently of the values of the other pollutants. Failing pollutants are adjusted to an FTP value that corresponds to the ST cut-point. If this value is below the FTP standard, the adjustment was made to the FTP standard.

The general effects of age and wear were simulated by deteriorating the emission rates from their value at the last inspection and maintenance point to the next I/M point. Deterioration effects on the uncontrolled fleet were based upon linear models with mileage accumulation. The vehicles were classified into two groups:

a) Vehicles passing the FTP
b) Vehicles failing the FTP

Certification deterioration factors were applied to vehicles in group a), and EFP factors were applied to vehicles in group b). The values used are shown in Table 1-6.

Deterioration effects on the controlled fleet were based upon piecewise linear models with mileage accumulation. The vehicles were classified into four groups (E_c, E_o, PP, and FF vehicles) and the following deterioration rates were applied.

a) PP Vehicles: Certification rates as shown in Table 1-6

b) E_o Vehicles: EFP rates as shown in Table 1-6

c) E_c Vehicles: Certification rates shown in Table 1-6. Deterioration occurs after the maintenance adjustments.

d) FF Vehicles: A maintenance effectiveness period is specified as an input to the simulation program. This period is the number of months (less than or equal to 12) required for the emissions to return to their value just prior to maintenance. After this period, if less than 12 months, the emissions are deteriorated according to the EFP rates as shown in Table 1-6. This situation is displayed in Figure 1-7.

Program effectiveness was based upon total mass of pollutants emitted since the inception of the program, reported annually. For each pollutant, the total grams emitted for each vehicle were calculated for the average mileage accumulations shown in Table 1-7. The total mass for each fleet was calculated by summing over each vehicle within the respective fleets. The effectiveness was then expressed as a percent reduction in mass pollutant from the uncontrolled fleet's levels.

1.2.3.1 Simulation Results

Table 1-8 summarizes the simulation results for the 207(b) approach for the 300-car fleet under the three maintenance versions examined; the values shown are based on a 12-month maintenance

Table 1-6. Average Deterioration Rates Used in 207(b) Effectiveness Simulation

Data Source	Rate of Deterioration in Grams/Mile per 1000 Miles		
	HC	CO	NO_x
Certification Values	0.014	0.084	0.0
EFP Values	0.072	0.800	0.0

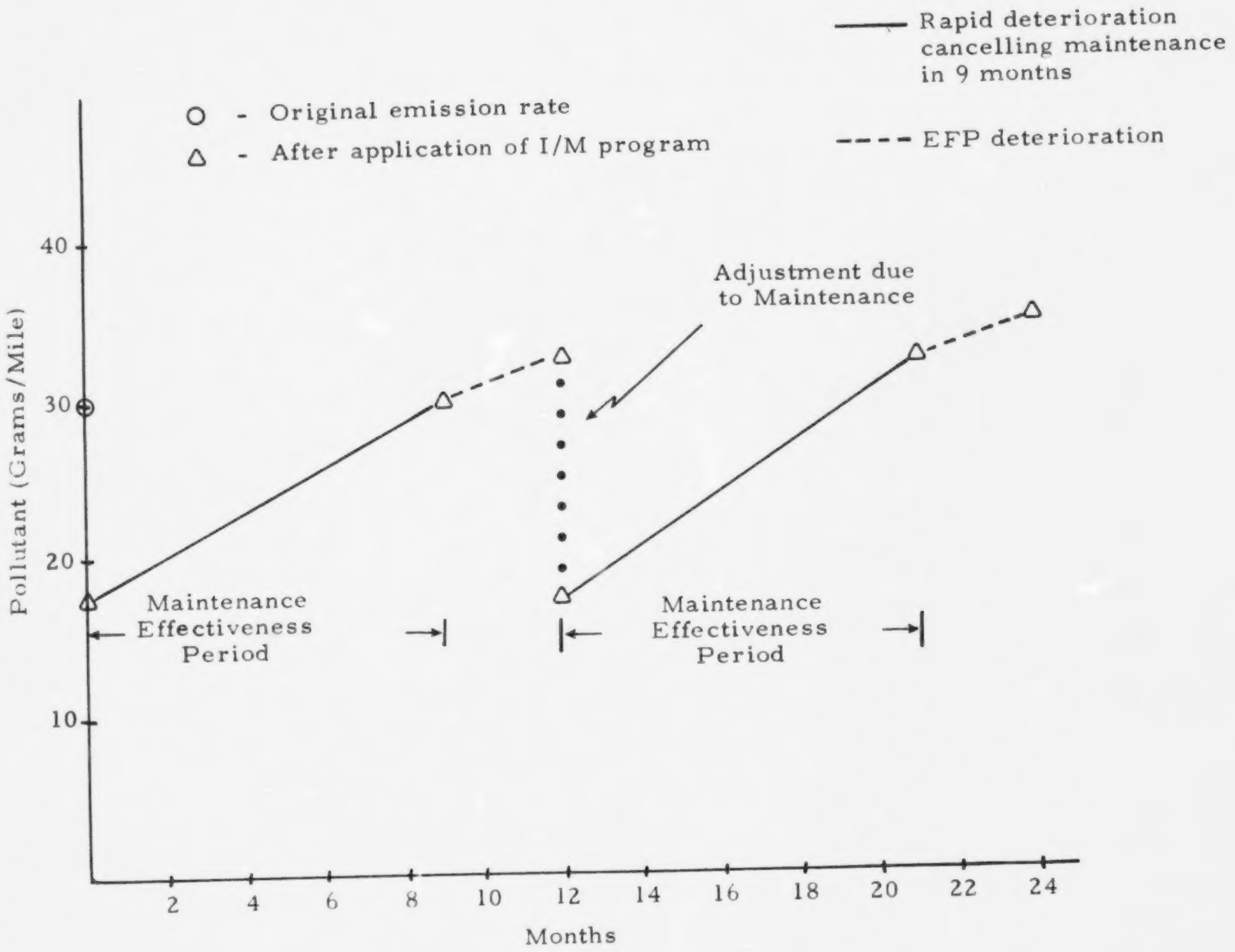

Figure 1-7. Piece-wise Linear Deterioration for FF Vehicles Shown Over Two-Year Period

Table 1-7. Annual Mileage Accumulations Used in 207(b) Effectiveness Simulation

Age of Vehicles in Years	Number of Years in Program	Accumulated Average Mileage [(a)]	
		Annual	Cumulative
1	0	17,500	17,500
2	1	16,100	33,600
3	2	13,200	46,800
4[(b)]	3[(b)]	3,200	50,000

(a) Nationwide Personal Transportation Study; Annual Miles of Automobile Travel, Report No. 2, April 1972, U. S. Department of Transportation

(b) Not a full year - simulation stops at 50,000 miles

Table 1-8. Variation of 207(b) Program[a] Effectiveness with Various Maintenance Assumptions; 300-Car Fleet; STRR = 1.0 Cut-Point Selection Technique

Maintenance Assumptions[b]	Emission Values Adjusted to:		No. of Years Since First Inspection	Estimated Program Efficiency in Percent (Cumulative)[c]					
				Federal Short Cycle			Federal Three-mode		
	FTP Standards	Equivalent ST Standards		HC	CO	NO_x	HC	CO	NO_x
VERSION NO. 1: HC and CO adjustments coupled,[e] NO_x adjustment independent	X		1	28.37	41.08	1.11	27.30	39.76	0.89
			2	38.22	47.85	0.80	37.08	46.55	0.67
			3[d]	41.11	51.31	1.00	40.00	50.03	0.86
VERSION NO. 2: HC, CO, and NO_x adjusted independently	X		1	28.37	35.06	1.11	27.30	33.95	0.89
			2	38.22	42.08	0.80	37.08	40.91	0.67
			3[d]	41.11	45.10	1.00	40.00	43.95	0.86
VERSION NO. 3: HC, CO, and NO_x adjusted independently		X	1	28.37	35.06	1.11	27.30	33.95	0.89
			2	38.22	42.08	0.80	37.08	40.91	0.67
			3[d]	41.11	45.10	1.00	40.00	43.95	0.86

[a] Pass-fail ST levels set for STRR = 1.0 rate for each pollutant for each of three engine CID groups (150 CID and less, 151 to 259 CID, 260 CID and greater).

[b] All three versions shown have 12-month maintenance period effectiveness; i.e., emissions return to pre-maintenance levels in 12 months.

[c] Percent efficiency is the percent reduction in fleet emissions from that value which would have occurred without the 207(b) program, over the time period shown.

[d] Not a full year. Program ended at 50,000 miles.

[e] When either HC or CO is adjusted, the other is adjusted with same percentage reduction; neither HC nor CO permitted to be less than one-half their respective FTP standard.

effectiveness period and the STRR = 1.0 cut-point selection technique. Maintenance versions 2 and 3 produced the same estimates of program efficiency. This occurred because the FTP value corresponding to the ST cut-point was lower than the FTP standard for HC, CO, and NO_x. Thus, in versions 2 and 3, all pollutants were adjusted to the FTP standards. Version 1 results showed more benefit to air quality than versions 2 and 3. However, the different maintenance versions affected CO only and the resulting differences in estimated benefit were quite small, rarely exceeding 10 percent.

Of greater importance is the assumption as to the maintenance period of effectiveness. This is illustrated in Table 1-9 for the 207(b) approach with maintenance version 3 for the 300-car fleet and the STRR = 1.0 cut-point selection technique. If the emissions of the maintained vehicles returned to pre-maintenance levels in six months instead of twelve months, for example, then the effectiveness of the program at the end of the 50,000 miles is substantially reduced (in the case of the Federal Three-mode ST from 40.0% to 27.0% for HC; from 44.0% to 28.4% for CO). This result merely quantifies the intuitive knowledge that "the quicker the erosion of maintenance effects, the less the overall impact of maintenance."

Table 1-10 illustrates the impact of ST cut-point selection technique on 207(b) program efficiencies for the 300-car fleet. For the same technique, both STs produced similar program efficiencies for HC and CO at the end of 50,000 miles, with maximum differences on the order of 10% for the E_c = 5% technique. In the case of the Federal Three-mode, all techniques except the E_c = 5% technique were in the range of 38 to 42 percent for HC efficiency and 41 to 46 percent for CO efficiency; similar values for the E_c = 5% technique were 33 and 38 percent, respectively. In the case of the Federal Short Cycle, all techniques were in the range of 36 to 42 percent for HC efficiency and 38 to 46 percent for CO efficiency. The STRR = 1.0 technique consistently produces near-maximum program efficiencies (of the techniques examined). The STE = 0.8

Table 1-9. Effect of Maintenance Period on 207(b) Program Efficiencies; Maintenance Version 3; 300 Car Fleet; STRR = 1.0 Cut-Point Selection Technique

Maintenance Period of Effectiveness	Number of Years Since the First Inspection	Estimated Program Efficiency in Percent (Cumulative)[b]					
		Federal Short Cycle			Federal Three Mode		
		HC	CO	NO_x	HC	CO	NO_x
12	1	28.37	35.06	1.11	27.30	33.95	0.89
	2	38.22	42.08	0.80	37.08	40.91	0.67
	3[a]	41.11	45.10	1.00	40.00	43.95	0.86
9	1	24.56	28.83	0.18	23.61	27.89	-0.01
	2	32.58	34.81	-0.11	31.52	33.77	-0.21
	3[a]	35.73	38.31	0.16	34.72	37.31	0.05
6	1	18.40	20.84	-0.75	17.66	20.12	-0.90
	2	24.27	25.31	-1.04	23.45	24.53	-1.11
	3[a]	27.80	29.22	-0.74	26.98	28.44	-0.82

[a] Not a full year. Program ended at 50,000 miles.

[b] Percent efficiency is the percent reduction in fleet emissions from that value which would have occurred without the 207(b) program, over the time period shown.

Table 1-10. Effect of ST Cut-Point Selection Technique on 207(b) Program Efficiencies; Maintenance Version 3; 12-Month Maintenance Effectiveness; 300-Car Fleet

Cut-point Selection Technique	Number of Years Since the First Inspection	Estimated Cumulative Program Efficiencies, Percent					
		Federal Short Cycle			Federal Three-mode		
		HC	CO	NO_x	HC	CO	NO_x
STRR = 1.0	1	28.37	35.06	1.11	27.30	33.95	0.89
	2	38.22	42.08	0.80	37.08	40.91	0.67
	3(a)	41.11	45.10	1.00	40.00	43.95	0.86
E_c = 5%	1	24.85	32.06	1.66	20.84	28.32	1.50
	2	34.55	39.07	1.40	29.99	34.98	1.38
	3(a)	37.44	42.13	1.56	32.92	38.07	1.55
STE = 0.6	1	24.05	28.28	2.02	25.35	30.47	1.12
	2	33.53	35.29	1.83	34.91	37.48	0.95
	3(a)	36.46	38.18	2.03	37.93	40.51	1.13
STE = 0.7	1	27.28	32.37	1.58	27.21	33.70	0.74
	2	37.01	39.50	1.36	37.14	40.82	0.52
	3(a)	39.95	42.48	1.57	40.08	43.88	0.73
STE = 0.8	1	28.77	35.40	0.77	28.73	35.35	0.13
	2	38.88	42.62	0.55	38.96	42.66	-0.06
	3(a)	41.73	45.61	0.76	41.82	45.64	0.17

(a) Not a full year. Program ended at 50,000 miles.

technique, which produces slightly higher program efficiencies than the STRR = 1.0 technique, can result in a greater number of vehicles being failed than should be failed, based upon FTP standards. This is shown by the graphical correlation of the techniques in Section 1.2.2, where STRR can be greater than 1.0 for STE = 0.8.

A comparison of the effectiveness of 207(b) and I/M program approaches is shown in Table 1-11. The program efficiencies of both approaches are nearly the same for both STs, indicating that basing pass-fail ST cut-points on engine displacement (the 207(b) approach) does not significantly affect overall fleet average emission reductions. However, the approach is still meritorious for its objective of preventing excessive errors of commission for the small CID vehicles as compared with large CID vehicles.

Table 1-12 summarizes the 207(b) program efficiencies of the 300-car and 117-car test fleets with the STRR = 1.0 cut-point selection technique. There are only slight differences in 50,000-mile program efficiencies (for both STs) between the low and high altitude (Denver) test fleets, despite the fact that there are significant differences in the average FTP emissions between Denver and the other three cities.

In all cases described above, for a fixed maintenance effectiveness period and a fixed maintenance version, the efficiency of the program increases as the duration of the program increases. Hence, the earlier the program can be instituted, the greater the resulting benefit to air quality and the higher will be the program efficiency at 50,000 miles.

It is emphasized that the program effectiveness values shown in Tables 1-8 through 1-12 are the result of the specific assumptions made, and are highly dependent upon the duration of the maintenance effectiveness period as well as the estimated effectiveness of the maintenance performed at the time of inspection. One limitation inherent in the three maintenance versions examined herein is that an E_c vehicle is always either an FF or E_o vehicle the following year. This results because of the deterministic approach employed; this limitation can perhaps be eliminated in future analyses through the use of stochastic maintenance models.

Table 1-11. Comparison of Effectiveness of 207(b) and I/M Program Approaches; Maintenance Version 3; 12-Month Maintenance Period Effectiveness; 300 Car Fleet; STRR = 1.0 Cut-Point Selection Technique

Program Type	Number of Years Since the First Inspection	Estimated Program Efficiency in Percent (Cumulative)[a]					
		Federal Short Cycle			Federal Three Mode		
		HC	CO	NO_x	HC	CO	NO_x
207(b) Program[b]	1	28.37	35.06	1.11	27.30	33.95	0.89
	2	38.22	42.08	0.80	37.08	40.91	0.67
	3[d]	41.11	45.10	1.00	40.00	43.95	0.86
I/M Program[c]	1	28.64	35.24	0.97	27.06	33.53	0.47
	2	38.63	42.38	0.67	36.99	40.74	0.25
	3[d]	41.48	45.38	0.86	39.92	43.79	0.45

[a] Percent efficiency is the percent reduction in fleet emissions from that value which would have occurred without the 207(b) program, over the time period shown.

[b] Pass-fail ST levels set for STRR = 1.0 rate for each pollutant for each of three engine CID groups (150 CID and less, 151 to 259 CID, 260 CID and greater).

[c] A single pass-fail level based on STRR = 1.0 for each pollutant for all cars in fleet, regardless of engine CID.

[d] Not a full year. Program ended at 50,000 miles.

Table 1-12. Comparison of Effectiveness of 207(b) Program on 300-Car and 117-Car Fleets; Maintenance Version 3; 12-Month Maintenance Period Effectiveness; STRR = 1.0 Cut-Point Selection Technique[b]

Fleet	Number of Years Since the First Inspection	Estimated Program Efficiency in Percent (Cumulative)[a]					
		Federal Short Cycle			Federal Three Mode		
		HC	CO	NO_x	HC	CO	NO_x
300-Car (Cities of Chicago, Houston, and Phoenix)	1	28.37	35.06	1.11	27.30	33.95	0.89
	2	38.22	42.08	0.80	37.08	40.91	0.67
	3[c]	41.11	45.10	1.00	40.00	43.95	0.86
117-Car (City of Denver)	1	34.05	35.37	1.11	31.68	32.56	0.86
	2	42.02	40.50	1.10	39.83	37.83	0.84
	3[c]	44.74	43.23	1.20	42.49	40.44	0.91

[a] Percent efficiency is the percent reduction in fleet emissions from that value which would have occurred without the 207(b) program, over the time period shown.

[b] Pass-fail ST levels set for STRR = 1.0 rate for each pollutant for each of three engine CID groups (150 CID and less, 151 to 259 CID, 260 CID and greater).

[c] Not a full year. Program ended at 50,000 miles.

1.3 EXTENDED ANALYSES OF 1974 MODEL YEAR AND 1975 PROTOTYPE VEHICLES

Extended contingency table analyses were performed using data collected on 147 1974-model-year vehicles and 26 catalyst-equipped 1975-prototype experimental vehicles. These data were originally reported in EPA-460/3-76-011, "Federal Test Procedure and Short Test Correlation Analyses." The present volume's analyses were performed to assess the sensitivity of ST/FTP correlations to FTP measurement variability and to assess the variability of the FTP.

1.3.1 FTP Replications on Catalyst-equipped 1975 Prototype Experimental Vehicles (CEV)

Using FTP replicate data from 26 cars of the CEV fleet, a contingency table analysis was performed in which the first value of the FTP replicate measurement pair for a given vehicle was assigned as the FTP measurement and the second value was taken as the corresponding ST measurement. Cut-points for HC, CO, and NO_x were selected for the "ST measurements" using the STRR = 1.0 technique. As discussed further in Section 3.1.1, this technique is equivalent to adjusting the ST number of failures to equal the number of FTP failures. Since the "ST" and the FTP under analysis here are replicate measurements from the 1975 FTP, the results of applying this technique may be used to estimate the repeatability of the 1975 FTP measurements.

The other relevant information produced by these analyses is the relative uncertainty in the FTP standards produced by the data. Although the FTP standards are fixed values in each analysis, the number of vehicles passing and failing the FTP varies from data set to data set and can be quantified in terms of FTP standard uncertainty which is produced by the measurement process.

The results of the analysis are summarized in Table 1-13. Since the HC and CO standards which the CEV fleet was designed to meet were unknown, four sets of FTP standards were used in the analysis, as shown in

Table 1-13. Comparison of Cut-Point Variability with Assumed FTP Standards for 26-Vehicle 1975-Prototype Catalyst-Equipped Fleet; STRR = 1.0 Cut-Point Selection Technique Using Replicate FTP Tests

Assumed FTP Standard (gr/mi)	Cut-point of Second FTP Test (gr/mi)	%FF	$\frac{\%E_c^{(1)}}{\%E_o^{(1)}}$	STE
HC				
0.41	0.42	64.46	5.74	0.92
0.60	0.59	39.52	6.59	0.86
0.75	0.72	26.14	5.93	0.82
0.90	0.85	17.26	4.91	0.78
CO				
3.4	3.35	18.37	5.39	0.77
5.0	4.81	4.61	2.28	0.67
7.0	6.59	0.90	0.66	0.58
9.0	8.34	0.20	0.19	0.51
NO_x				
3.1	2.99	11.37	8.37	0.58
Multiple Constituent				
0.41, 3.4, 3.1	as noted above for	61.54	$\frac{15.38}{3.85}$	0.94
0.60, 5.0, 3.1	individual	30.77	$\frac{0.0}{7.69}$	0.80
0.75, 7.0, 3.1	pollutants	30.77	$\frac{0.0}{0.0}$	1.00
0.90, 9.0, 3.1		19.23	$\frac{3.85}{7.69}$	0.71

(1) $E_c = E_o$ at STRR = 1.0 for single constituents.

the table. The differences between the FTP standards at all levels and the cut-points corresponding to this set of standards are negligible for all three pollutants. At the lowest level of FTP standards, the estimated total error rates ($E_o + E_c$) are 11.4% HC, 10.8% CO, 16.8% NO_x, and 19.2% on the multiple-constituent test basis.

In the case of CO, the ability of the cut-point of the second test to track the standard deteriorated as the standard increased. The decreasing total error rate, coupled with the extreme decrease in correctly failed (FF) rate (18% at 3.4 grams/mile to 0.2% at 9.0 grams/mile) shown in Table 1-13, indicates that the analysis at the higher values of the CO standard is being performed on a "tail" of the distribution; i.e., when the probability of vehicles having high emission values is extremely low. Thus, the parameters shown at the lower values of the CO standard will be more representative of the character of the FTP measurement process.

In the case of NO_x, however, even though the cut-point closely approximates the NO_x standard, there is a relatively high total error rate (16.8%) in proportion to the vehicles correctly failed (11.37%), as well as sensitivity of parameters to shifts in the cut-point. For example, a 0.15 gram/mile difference (5%) about the standard level of 3.1 grams/mile will cause a 30% change in STRR and a 17% change in STE.

1.3.2 Analysis of In-use 1974 Model Year Vehicles by Inertia Weight Class

The 144-car fleet of 1974 model year vehicles consisted of three inertia weight classes as follows.

a) 2501 to 3500 lb: 46 Ford Pintos at 2750 lb and 140 CID

b) 3501 to 4500 lb: 49 Dodge/Plymouths at 4000 lb and 318 CID

c) 4501 and above: 49 Chevrolets at 5500 lb and 400 CID

Table 1-14 presents the STE variations as a function of inertia weight class for short-test cut-point selection techniques of STRR = 1.0 and

Table 1-14. Variation of STE with Inertia Weight Class; 1974 Model Year Fleet; Short Test Cut-Point Selection Techniques of STRR = 1.0 and E_c = 5 Percent

Cut-point Technique	Short Test	Inertia Weight	Test Mode	Short Test Effectiveness (STE)			
				HC	CO	NO_x	Multiple Constituents
STRR = 1.0	Federal Short Cycle	All		0.79	0.90	0.50	0.86
		2501 to 3500 lb		0.68	0.92	0.19	0.89
		3501 to 4500 lb		0.93	0.98	0.68	0.96
		4501 and above		0.18	0.71	0.55	0.68
	Federal Three-mode	All	idle in drive	0.57	0.86	-	0.82
			high speed	-	-	0.44	-
		2501 to 3500 lb	idle in drive	0.44	0.84	-	0.86
			high speed	-	-	0.27	-
		3501 to 4500 lb	idle in drive	0.86	0.95	-	0.96
			high speed	-	-	0.51	-
		4501 and above	idle in drive	0.01	0.65	-	0.74
			high speed	-	-	0.48	-
E_c = 5%	Federal Short Cycle	All		0.75	0.84	0.38	0.77
		2501 to 3500 lb		0.74	0.90	0.35	0.86
		3501 to 4500 lb		0.92	1.00	0.55	0.96
		4501 and above		0.46	0.42	0.41	0.45
	Federal Three-mode	All	idle in drive	0.32	0.69	-	0.70
			high speed	-	-	0.30	-
		2501 to 3500 lb	idle in drive	0.37	0.56	-	0.46
			high speed	-	-	0.50	-
		3501 to 4500 lb	idle in drive	0.62	0.95	-	0.94
			high speed	-	-	0.27	-
		4501 and above	idle in drive	0.02	0.27	-	0.52
			high speed	-	-	0.31	-

E_c = 5%. With either technique, the considerable variation of STE for each pollutant with inertia weight is evident, with both short tests less effective in correctly tracking the FTP failures in the larger vehicles. However, these results can also be interpreted as manufacturer-peculiar, in that each inertia weight class was built by a different manufacturer.

Table 1-15 compares the E_c = 5% data of Table 1-14 for the Federal Three-mode with similar data from the 300-car pooled fleet reported in Volume I. The 300-car fleet shows the same general trends as the 144-car fleet; i.e., higher STE values for the smaller vehicles than for the large vehicles for HC, CO, and NO_x, but with less marked changes between groups. The various inertia weight groups of the 300-car fleet were made up of vehicles from several different manufacturers in each inertia weight group. Therefore, the 144-car fleet results, with a single manufacturer in each group, confound the technological and weight effects.

On an overall fleet basis, both fleets had very similar STE values for each pollutant and nearly identical values for the multiple-constituent test. The persistence of the idle mode as an effective ST on HC and CO, and of the high-speed mode for NO_x discrimination in both fleets, is an important finding which reflects a basic invariant in the Federal Three-mode.

1.4 SHORT TEST VARIABILITY

Tables 1-16 and 1-17 contain the ST cut-points and standard errors at each cut-point for the Federal Short Cycle and Federal Three-mode, respectively, for the 300-car fleet (refer to Section 5 for computational details). Results are included for each individual pollutant and for each cut-point selection technique defined in Section 1.2.1. By referring to Figures 1-3 through 1-5 for the Federal Three-mode, it can be seen that the rank ordering of cut-points by numerical value in Table 1-17 for each pollutant conforms to the rank ordering of STE values in the figures; i.e., the lowest cut-point conforms to the highest STE, etc.

Table 1-15. Comparison of STE Values with Inertia Weight Variation for 1974 and 1975 Model Year Fleets; Federal Three-Mode ST; Cut-Point Technique E_c = 5 Percent

Pollutant	Inertia Weight	Test Mode	STE	
			147-Car 1974 Model Year Fleet	300-Car 1975 Model Year Fleet
Hydrocarbon	All	idle in drive	0.32	0.375
	0 to 2500 lb		-	0.293
	2501 to 3500 lb		0.37	0.439
	3501 to 4500 lb		0.62	0.340
	4501 and above		0.02	0.385
Carbon Monoxide	All	idle in drive	0.69	0.562
	0 to 2500 lb		-	0.583
	2501 to 3500 lb		0.56	0.617
	3501 to 4500 lb		0.95	0.533
	4501 and above		0.27	0.509
Oxides of Nitrogen	All	high speed	0.30	0.310
	0 to 2500 lb		-	0.552
	2501 to 3500 lb		0.50	0.315
	3501 to 4500 lb		0.27	0.214
	4501 and above		0.31	0.114
Multiple Constituents	All	idle in drive	0.70	0.704
	0 to 2500 lb		-	0.696
	2501 to 3500 lb		0.46	0.771
	3501 to 4500 lb		0.94	0.637
	4501 and above		0.52	0.693

Table 1-16. ST Cut-points and Their Standard Errors for the Federal Short Cycle; 300 Cars

ST Cut-point Technique	Cut-points and Standard Errors in gr/mi					
	HC		CO		NO_x	
	CP[1]	SE[2]	CP	SE	CP	SE
STRR = 1.0	[illegible].09	0.077	5.17	0.618	2.45	0.112
$\frac{E_c}{E_c + FF}$ = 0.1	2.06	0.190	9.91	1.201	3.69	0.235
= 0.2	1.37	0.108	4.51	0.542	3.00	0.157
E_c = 5 %	1.32	0.121	8.40	1.312	2.62	0.134
STE = 0.6	1.29	0.117	11.25	1.367	2.63	0.157
0.7	1.07	0.099	8.12	1.001	2.38	0.144
0.8	0.86	0.085	5.60	0.728	2.12	0.137

(1)CP = Cut-point

(2)SE = Standard Error

Table 1-17. ST Cut-points and Their Standard Errors for the Federal Three-mode;(3) 300 Cars

ST Cut-point Technique	Cut-points and Standard Errors in ppm					
	HC		CO		NO_x	
	CP(1)	SE(2)	CP	SE	CP	SE
STRR = 1.0	112	8.7	2198	384	1803	85
$\frac{E_c}{E_c + FF} = 0.1$	573	99.1	12945	2409	-	-
$= 0.2$	298	32.6	2956	515	4379	552
$E_c = 5\ \%$	184	21.1	7081	1857	2265	149
STE = 0.6	112	12.6	5867	1157	1558	123
= 0.7	89	10.3	3475	703	1362	112
= 0.8	68	8.5	1898	412	1164	103

(1) CP = Cut-point

(2) SE = Standard Error

(3) HC and CO idle in drive; NO_x at the high speed

With regard to the effects of vehicle size, as reflected by engine displacement, Tables 1-18 and 1-19 show the cut-point and standard error values for the three CID groups examined in the 300-car fleet for the cut-point selection technique of STRR = 1.0. The variation between the fleet average and the individual groups is particularly marked for CO, and illustrates why small cars (CID = 150 and less) would have an excessive failure rate if the short-test cut-point were based on the overall fleet cut-points, and why the large cars (CID = 260 and greater) would have a low failure rate.

The dispersion of the ST cut-points is summarized in Table 1-20 for the 300-car and 117-car fleets at the STRR = 1.0 cut-point selection technique, where

$$\text{Dispersion} = \frac{\text{Standard error at cut-point}}{\text{Cut-point value}}$$

For the 300-car fleet, the dispersion values of the Federal Short Cycle and the Federal Three-mode are comparable. In the case of the 117-car fleet, more variation is shown for the Federal Three-mode, particularly for CO. The effect of the smaller sample size is primarily responsible for the increased dispersion of the 117-car fleet cut-points as compared with the 300-car fleet.

Table 1-18. Comparison of Standard Errors for Federal Short Cycle; 300 Cars; STRR = 1.0

CID Group	Number of Vehicles	Cut-points and Standard Errors in gr/mi					
		HC		CO		NO_x	
		CP[(1)]	SE[(2)]	CP	SE	CP	SE
All	300	1.09	0.077	5.17	0.618	2.45	0.112
≤ 150 CID	95	1.03	0.125	8.90	1.163	2.33	0.224
151 - 259 CID	54	0.96	0.168	4.47	1.067	2.50	0.246
≥ 260 CID	151	1.07	0.118	3.75	0.772	2.49	0.137

(1) CP = Cut-point

(2) Standard Error

Table 1-19. Comparison of Standard Errors for Federal Three-Mode[3]; 300 Cars; STRR = 1.0

CID Group	Number of Vehicles	Cut-points and Standard Errors in ppm					
		HC		CO		NO_x	
		CP[1]	SE[2]	CP	SE	CP	SE
All	300	112	8.7	2198	384	1803	85
≤ 150 CID	95	124	16.8	5907	1464	2475	259
151 - 259 CID	54	138	21.7	2446	915	1572	154
≥ 260 CID	151	97	10.9	1121	315	1589	93

[1] CP = Cut-point

[2] SE = Standard Error

[3] HC and CO idle in drive; NO_x at the high speed

Table 1-20. Comparison of ST Dispersion for STRR = 1.0 by Fleet and ST

Vehicle Fleet	ST	ST Cut-Point Dispersion(1)		
		HC	CO	NO_x
300 Cars (Low Altitude)	Federal Short Cycle	0.071	0.120	0.046
	Federal Three-mode(2)	0.078	0.175	0.047
117 Cars (High Altitude)	Federal Short Cycle	0.093	0.183	0.110
	Federal Three-mode(2)	0.127	0.326	0.132

(1) Dispersion = (Standard Error of the cut-point) ÷ (cut-point)

(2) HC, CO idle in drive, NO_x at high speed

2. SHORT TEST CORRELATION ANALYSES ON DENVER VEHICLES

Conventional correlation analyses and contingency table analyses were conducted for the 117-vehicle 1975 model year Denver fleet. This section describes the composition of the Denver test fleet and presents the results of the short test (ST) analyses.

2.1 DENVER FLEET COMPOSITION

Two short tests (STs) and the 1975 Federal Test Procedure (FTP) were performed by EPA on the 117-vehicle test fleet during the FY 74 Emission Factor Program. The STs (the Federal Short Cycle and the Federal Three-Mode) are described in Section 3.1 of Volume 1.

2.1.1 Test Fleet Composition

All 117 vehicles were 1975 model year vehicles representing a typical cross-section of that model year with regard to manufacturer (domestic and foreign), vehicle size (weight), engine size (displacement and number of cylinders), fuel system type, transmission type, and emission control system type. Tables 1 through 10 in the Appendix list cross-tabulations of specific features of the vehicle fleet in the following context.

Cross-Tabulation Feature	Table Number*
No. of cylinders vs engine displacement	1
Inertia test weight vs engine displacement	2
Emission control system vs engine displacement	3
Inertia test weight vs emission control system	4
Fuel system vs emission control system	5
Fuel system vs inertia test weight	6
Fuel system vs engine displacement	7
Transmission vs engine displacement	8
Transmission vs inertia test weight	9
Manufacturer vs engine displacement	10

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*Table numbers refer to tables contained in the Appendix

Engine displacement was subdivided into three sizes:

a. 150 cubic inches displacement (CID) or less
b. 151 to 259 CID
c. 260 or more CID

Inertia test weight breakdown was limited to four categories:

a. 2500 lb or less
b. 2501 lb to 3500 lb
c. 3501 to 4500 lb
d. 4501 lb or greater

Emission control system description was limited to the use or non-use of oxidation catalysts and/or secondary air injection.

Fuel system type description refers to the use of either carburetion or fuel injection.

Transmission type refers to use of manual versus automatic transmissions.

2.1.2 Prior Use

At the time of receipt of these vehicles by the testing laboratory (Automotive Testing Laboratories, Inc.), the odometer readings ranged from about 1000 to 40000 miles, with an average of 13315 miles. Specific vehicle use patterns, in terms of city driving vs highway driving, were not quantified. The type and extent of vehicle and emission system maintenance were similarly undefined. It was assumed that the use and state-of-maintenance characteristics of this test sample would be adequately representative of the 1975 model year vehicle population from high altitude cities.

2.2 STATISTICAL SCREENING AND CORRELATION ANALYSES

In studying the degree of correlation that exists between a particular short test (ST) and the Federal Test Procedure (FTP), a major concern is the dependency of correlation on vehicle population characteristics. This is, it is important to know which classes of vehicles, if any, show poor ST/FTP correlations. Thus, correlations on characteristic specific groupings of the data were assessed. In addition to assessing differences in correlation, differences in group FTP means and FTP standard deviation were also reviewed. For a discussion of the methods employed, the reader is referred to Section 4.1 of Volume I.

2.2.1 Results for the Denver Fleet

Table 11 shows the FTP means and standard deviations for each pollutant in the four cities Chicago, Houston, Phoenix and Denver. That the Denver means are substantially different from those of the other three cities is expected (Reference 1) and fundamentally constitutes the reasoning for separate analysis of vehicle emissions data collected in Denver or other high altitude cities. The ST/FTP correlation coefficients for the Denver fleet are shown in Table 12.

An analysis to determine the effects of engine displacement, inertia test weight, emission control system, manufacturer, transmission type, and fuel system was performed on the pooled Denver fleet of 117 vehicles. The effect of vehicle mileage was also investigated. The vehicles were grouped into those with 4000 miles or less and those with more than 4000 miles. The table numbers for both STs correspond to the following statistics spectrum.

For the Effects of	Table Number	
	FTP Mean and Standard Deviations	ST/FTP Correlation Coefficients
Engine Displacement	13	14
Inertia Test Weight	15	16
Emission Control System	17	18
Manufacturer	19	20
Transmission Type	21	22
Fuel System	23	24
Mileage	25	26

The comparable tables for the three cities results are 25 - 75 in Volume I.

2.2.2 Discussion of Results

2.2.2.1 Short Test Comparison

Comparing the Denver results, Table 12, to the three cities results, Tables 21 - 24 of Volume I, reinforces the general ST properties previously documented in Volume I. The Federal Short Cycle shows high correlation with the FTP on all three pollutants. The idle modes, particularly idle in drive, of the Federal Three-Mode are the superior modes for HC and CO correlation while the high and low speed modes show higher NO_x correlation than do the idle modes.

2.2.2.2 Effect of Engine Displacement

In the case of the Federal Short Cycle (see Table 14), NO_x correlations were largely unaffected by engine cubic inch displacement (CID) class and were similar to the total fleet values. The CO correlation of the 151-259 CID group was significantly lower than the fleet average (and largest engine size group). The CO correlation of the 150 CID or less group was slightly lower than the fleet average. In terms of HC discrimination, the 260 CID or more group had a slightly higher correlation coefficient than the fleet average, the 150 CID or less group was slightly less than the fleet average, and the 151 to 259 CID group was significantly lower (0.40) than the fleet average (0.81). As this effect was also noted in the 300 car fleet, a possible explanation for the poorer HC and CO correlation values for the small CID groups is that these groups represented several technologies for HC and CO control (e.g., with and without catalysts, both carburetion and fuel injection, with and without air injection), whereas the large displacement vehicles were principally equipped with carburetors and oxidation catalysts.

For the Federal Three-Mode ST, similar trends are observed for NO_x in the high-speed mode and the low-speed mode, and for CO in the idle in drive and neutral modes. HC correlation coefficients in the idle in drive mode for the two smaller CID groups are lower than the 260 CID and above group, and also lower than the fleet average. Again, the better test modes of the Federal Three-Mode (for a given pollutant) tend to show the same types of trends with engine displacement as the Federal Short Cycle.

2.2.2.3 Effects of Inertia Test Weight Group

The Federal Short Cycle results indicate that NO_x correlations decrease with increasing inertia test weight (see Table 16). However, due to the small sample sizes on some of the groups, the differences are statistical in origin. The HC and CO correlation coefficients are lowest for the 2501-3500 lb group while the 0-2500 lb or less group shows higher than fleet average correlation.

For the Federal Three-Mode, the NO_x correlation coefficients are lowest for the 2500 lb or less inertia weight group. The HC idle in drive mode correlation coefficients increase with increasing inertia weight while CO idle in drive correlation appears to be insensitive to inertia weight.

2.2.2.4 Effect of Emission Control System Type

The correlation coefficients of the Denver vehicle fleet were determined as a function of the usage or non-usage of oxidation catalysts and/or secondary air injection for control of HC and CO. In the case of the Federal Short Cycle results (Table 18), the data indicates generally higher HC and CO correlations with the use of a catalyst (with or without secondary air). NO_x correlations are relatively unaffected by the use or non-use of catalysts and/or secondary air injection.

The Federal Three-Mode results are less clear. CO correlation appears generally higher on the vehicles having catalysts. HC correlation is also judged to be higher on catalyst equipped vehicles since the correlation coefficients for these groups are statistically significant at the 95% cofidence level. The NO_x high and low-speed correlation coefficients are slightly higher for vehicles having secondary air injection than for vehicles not equipped with air injection.

2.2.2.5 Effect of Manufacturer

On the Federal Short Cycle (see Table 20), the domestic vehicles have correlation coefficients of 0.70 or higher on all three pollutants.

Ford had the highest HC and CO coefficients (0.99 and 0.97, respectively) but the lowest NO_x coefficient (0.73). Chrysler had the lowest HC coefficient (0.76) of the domestics while General Motors had the lowest CO coefficient (0.78) of the domestics. The "others" category (primarily small imported vehicles) had the lowest HC (0.63) and CO (0.48) correlations, with a NO_x value (0.91) higher than Ford and Chrysler values. Again, the multiplicity of technologies used for HC and CO control in the small import class could be responsible for the observed lower correlations when grouped into the single category.

On the Federal Three-Mode ST, the high speed test mode resulted in generally similar NO_x correlation coefficient levels (0.63 to 0.75) for all manufacturers except Chrysler, which had a value of 0.35. General Motors, Chrysler and "others" vehicles had slightly higher NO_x coefficients in the low speed mode than in the high speed mode. In the case of CO in the idle in drive test mode, Ford ranked lowest (0.49) of all the manufacturers but only slightly lower than the "others" category (0.53). The HC coefficient in the idle in drive mode shows trends similar to that in the Federal Short Cycle with values ranging from 0.53 to 0.84.

2.2.2.6 Effect of Transmission Type

Eighty-seven of the 117-vehicle test fleet were equipped with automatic transmissions; the remainder were equipped with manual transmissions. With the Federal Short Cycle ST (Table 22), the NO_x correlation coefficient was insensitive to transmission type, whereas both HC and CO correlation coefficients were significantly reduced for manual transmission vehicles.

In the case of the Federal Three-Mode ST, the situation is similar for NO_x. For HC and CO, the only comparative basis is the idle in neutral test mode, since the manual transmission prevents the idle in drive test mode. Here the CO correlation coefficients are similar for both transmissions (0.72 and 0.60), and the HC coefficient for the manual transmission (0.01) is considerably lower than the automatic transmission value (0.75).

2.2.2.7 Effect of Carburetion vs Fuel Injection

Ten vehicles of the 117-vehicle test fleet were equipped with fuel injection. The fuel injected vehicles had significantly poorer Federal Short Cycle correlation coefficients for HC than the carbureted vehicles (Table 24). With the Federal Three-Mode ST, this was reversed for NO_x; in the high speed test mode the fuel injected NO_x coefficient (0.80) was higher than the carbureted value (0.64). The HC and CO correlation coefficients on the idle modes are not statistically different from zero (the absence of correlation). This is most likely due to the small samples involved.

2.2.2.8 Effect of Accumulated Mileage

Seven of the 117 vehicles had accumulated 4000 miles or less prior to being tested (Table 26). The only noticeable effect for the Federal Short Cycle is that these 7 vehicles had a lower CO correlation than the 110 vehicles with greater than 4000 mileage accumulation. In the case of the Federal Three-Mode, the results for the greater than 4000 mileage group were generally similar to those for the total 117-vehicle fleet. Those vehicles in the 4000 mile or less group would also have to be judged as similar to the total 117-vehicle fleet since seven constitutes a small, highly variable sample.

2.3 CONTINGENCY TABLE ANALYSES

The contingency table analysis technique was used to establish the ST pass-fail levels for each pollutant. For a discussion of the relevant methodology, the reader is referred to Section 5.1 of Volume I.

2.3.1 Analyses and Results of the Denver Vehicles

Using the entire 117 car data set, ST cut-points for HC, CO, and NO_x were determined for a 5% error of commission rate. Additionally, group-specific ST cut-points for each pollutant were determined for each CID class at the 5% E_c rate. The results are discussed below first by individual pollutant, followed by the results of the multiple constituent tests. However, the results for both ST are given in Tables 27 through 34 as follows:

Short Test	Constituent Table Number			
	HC	CO	NO_x	Three Constituents
Federal Short Cycle	27	29	31	33
Federal Three-Mode	28	30	32	34

2.3.2 Discussion of Results

2.3.2.1 Hydrocarbon Emission

In the case of the Federal Three-Mode ST, the STE and STRR values varied slightly (0.45 to 0.55 and 0.55 to 0.63 respectively) from mode to mode when the pooled fleet of 117 vehicles was analyzed (Table 28). The single best mode was the low-speed mode (STE=0.55, STRR=0.63) with the idle-in-neutral mode a close second (STE=0.54, STRR=0.61). The STE and STRR varied considerably between CID groups. The maximum (within CID) STE was lowest (0.47) for the 150 CID and less group in low speed and highest (0.74) for the 260 CID and greater group in neutral with corresponding STRR values of 0.54 and 0.81, respectively.

In comparison, the STE value for the Federal Short Cycle ST (Table 27) ranges from 0.50 to 0.84 for the CID groups and is 0.78 for the pooled 117-vehicle fleet. The STRR value ranges from 0.60 to 0.91 for the CID groups and is 0.85 for the pooled fleet.

2.3.2.2 Carbon Monoxide Emission

The STE value for the Federal Three-Mode ST shows little difference (0.89 to 0.91) between modes for the pooled 117-vehicle fleet (Table 30). Similarly, the STRR value ranges from (0.95 to 0.97). The STE value is uniformly the highest for the idle-in-neutral mode when examining the individual CID groups (values range from 0.87 to 0.99). The corresponding STRR value ranges from 0.93 to 1.04.

In the case of the Federal Short Cycle (Table 29), there is similarly little difference in STE and STRR values between the CID groups.

2.3.2.3 Oxides of Nitrogen Emission

The high-speed mode of the Federal Three-Mode ST uniformly had the highest STE values, 0.41 for the pooled fleet and 0.39 to 0.62 for the CID groups (Table 32). The low-speed mode had the highest STRR values, 1.30 for the pooled fleet and 1.09 to 2.28 for the CID groups. NO_x discrimination was best for the 150 CID and less group and declined with increasing CID.

The Federal Short Cycle ST had STE values ranging from 0.69 to 0.82 for the CID groups with STRR ranging from 1.62 to 1.93 (Table 31). The pooled fleet had a STE of 0.74 and a STRR of 1.62.

2.3.2.4 Multiple-Constituent Tests

In addition to analyzing each pollutant individually, an analysis was made for three-constituent tests. In a three-constituent test, a car fails the ST if any of its HC, CO, or NO_x measurements exceed the previously determined cut-points for each pollutant.

In the case of the Federal Short Cycle ST (Table 33), STE values over 0.9 were achieved on all CID groups and the pooled fleet. The STRR value ranged from 0.9 to 1.07 for the CID groups and was 1.04 for the pooled fleet.

The "best" mode category shown for the Federal Three-Mode ST (Table 34) refers to the combination of the best individual test modes: the low-speed mode for HC, CO, and NO_x discrimination, as determined by the correlation coefficients of the pooled fleet. Although this "best" mode shows relatively high STE on all three CID groups (0.71 to 0.84), the idle-in-neutral mode is slightly superior: 0.84 on the 150 CID and less, 0.73 on the 151-259 CID, and 1.00 on the 260 CID and greater. For the pooled fleet the STE value ranged from 0.81 (neutral) to 0.93 (low-speed). The corresponding STRR values ranged from 0.71 (150 CID and less) to 1.08 (260 CID and greater) on the CID groups and 0.83 to 0.94 on the pooled fleet.

2.4 DISCUSSION AND CONCLUSIONS

2.4.1 Conventional Correlation Analyses

The Federal Short Cycle/FTP correlation does not appear to be altitude dependent based upon a comparison of the correlation coefficients for HC, CO, and NO_x calculated for Denver vs the other three cities: (0.81, 0.88, 0.82 vs 0.78, 0.89, 0.81). Thus even though there are significant differences between the average FTP emission in high and low altitude locales, the Federal Short Cycle retains the ability to track FTP measurements.

In comparing the Federal Three-Mode correlation coefficients, the Denver high and low speed mode NO_x correlation (0.64 and 0.70) show an improvement over the corresponding three cities correlation coefficients (0.52 and 0.48). The Denver CO correlation (0.65 idle-neutral and 0.62 idle-in-drive) although slightly less, is comparable to the three cities results (0.69 and 0.67 respectively). Denver HC correlation (0.31) is lower than the three cities result (0.45) for the idle-in-neutral mode but higher (0.74 compared to 0.58) for the idle-in-drive mode.

Federal Three-Mode CO correlation shows some degree of altitude invariance. The difference in NO_x correlation may be more attributable to the variable humidity while testing in the three cities. For example, the high and low-speed NO_x correlation coefficients in Phoenix, with its less variable humidity, were computed to be 0.73 and 0.66 respectively. These values compare more closely with Denver than do the pooled three cities results. The trend for HC correlation is similar in Denver; higher correlation on the idle-in-drive mode than on the idle-in-neutral mode. However, the values of the correlation coefficients are more variable. These results do hint at altitude invariance but also suggest a higher degree of variability in the Federal Three-Mode correlation coefficients than in the Federal Short Cycle correlation coefficients.

The HC and CO correlations in Denver for the high and low speed mode are substantially higher than the corresponding correlations in the three cities. Thus, an altitude dependency at least on HC and CO at the high and low speed modes is suggested.

2.4.2 Contingency Table Analyses

In the case of the Federal Short Cycle ST, the STE values for HC, CO, NO_x, and the multiple-constituent test are approximately 50%, 50%, 23%, and 18% higher, respectively, in Denver than in the other three cities. For the Federal Three-Mode ST the STE values are approximately 40%, 60%, 32% and 36% higher in Denver than in the other three cities for HC, CO, NO_x and the multiple constituent tests. This is a direct result of positive ST/FTP correlation and the FTP standards (1.5 gm/mi HC, 15.0 gm/mi CO, and 3.1 gm/mi NO_x) being substantially lower than the average vehicle's emissions, i.e., approximately 91% of the Denver vehicles' emissions exceed at least one of the FTP standards (primarily HC and CO) as compared to about 65% for the three cities fleet.

The STRR values show a similar trend to the STE values when Denver results and three cities results are compared.

The increased short test effectiveness is due primarily to large differences in FTP standard and the average vehicle's emission for HC and CO. The increased NO_x STE may be attributable to small variations in relative humidity.

3. EXTENDED ANALYSES OF FOUR CITIES DATA

This section contains the results of extended analyses using the three cities data from Volume I plus the Denver data described in Section 2 of this volume. These analyses were performed to determine the sensitivity of correlations and emission reductions resulting from various short test cut-point selection methods.

3.1 DISCUSSION OF METHODOLOGY

As noted in Volume I, the ST cut-points selected for the pooled 300-car fleet on the basis of a given E_c rate resulted in varying E_c rates for characteristic specific groups of vehicles. For example, vehicle groups determined by vehicle size (CID) and manufacturer showed wide variations in E_c, STE, and STRR from the overall fleet values. Therefore, it may be desirable to select ST cut-points on the basis of vehicle size, manufacturer, and technology in order to minimize the variation in E_c, STE, and STRR between vehicle classifications.

By selecting group-specific cut-points based on a given E_c rate, the variation of E_c between groups is minimized. When a fixed level of E_c is used to determine the cut-point, the resulting values of STE and STRR may still vary from group to group, since the cut-point cannot be established on the basis of more than one parameter. Clearly, if it is desired that all the vehicle cut-point classifications have STE = 0.7, cut-point selection should be based upon STE at the fixed value of 0.7; likewise if STRR = 1.0 is desired.

In order to assess the properties of alternative cut-point selection techniques, three new selection techniques were introduced: fixed short test rejection ratio, fixed short test effectiveness, and fixed ratio of E_c to (E_c + FF). Contingency table analyses were performed selecting ST cut-points using these techniques as well as fixed E_c rate (as determined in Volume I) for the purpose of comparative analysis. Computer simulations of a 207(b) program implemented using the cut-points as determined by the various techniques were conducted for the purpose of comparing the impact of the cut-point selection technique upon program efficiency.

With regard to the contingency table technique, deviation from the basic procedures described in Section 5.1 of Volume I was minimal; however, each cut-point selection technique is described below in detail. The simulation technique remained the same as described in Section 6 of Volume I.

3.1.1 Fixed Short Test Rejection Ratio

The technique STRR = 1.0 is equivalent to selecting the ST cut-point such that the ST failure rate equals the FTP failure rate:

$$E_c + FF = FF + E_o$$

$$\text{(ST failures)} = \text{(FTP failures)} \qquad (3\text{-}1)$$

For a fixed FTP standard and pollutant, the number of FTP failures is estimated by the number of vehicles exceeding the standard. The ST cut-point is that value of the ST which results in the same number of failures. That is, the number of ST failures equals the number of FTP failures. The cut-points were determined for each pollutant individually.

Both parametric and non-parametric methods were employed for comparison. In the parametric method, a statistical distribution model (Reference Section 5.1 of Volume I) is fitted to the ST/FTP data and then the pertinent probability equations are solved, as illustrated in Figure 3-1. For the non-parametric method, the ST measurements are ranked in ascending order. Thus, the number of vehicles having ST readings which are less than the reading of rank K is K-1. The ST cut-point is estimated by the value of the ST measurement of rank K^* where $K^* = 1 +$ (the number of vehicles passing the FTP). Notice that the number of vehicles equal to or exceeding this cut-point is $N-K^*-1$ which equals N- (the number of FTP

Short Test Rejection Ratio Equals 1.0: Solve for C_2

$$\gamma = \int_{-\infty}^{\infty}\int_{C_2}^{\infty} D(X_1, X_2)\, dX_1 dX_2$$

where

C_2 = ST Cut-Point
γ = Estimated probability of failing the FTP
$D(.,.)$ = Bivariate normal (or log-normal) density function as determined by the ST and FTP data

Figure 3-1. Equation for ST Cut-Point Determination; STRR = 1.0

passes) or the number of FTP failures, N being the total number of vehicles in the sample. Hence, ST failures equal FTP failures, and STRR is 1.0.

3.1.2 Fixed $E_c/(E_c + FF)$

The technique $E_c/(E_c + FF) = \alpha$ is equivalent to

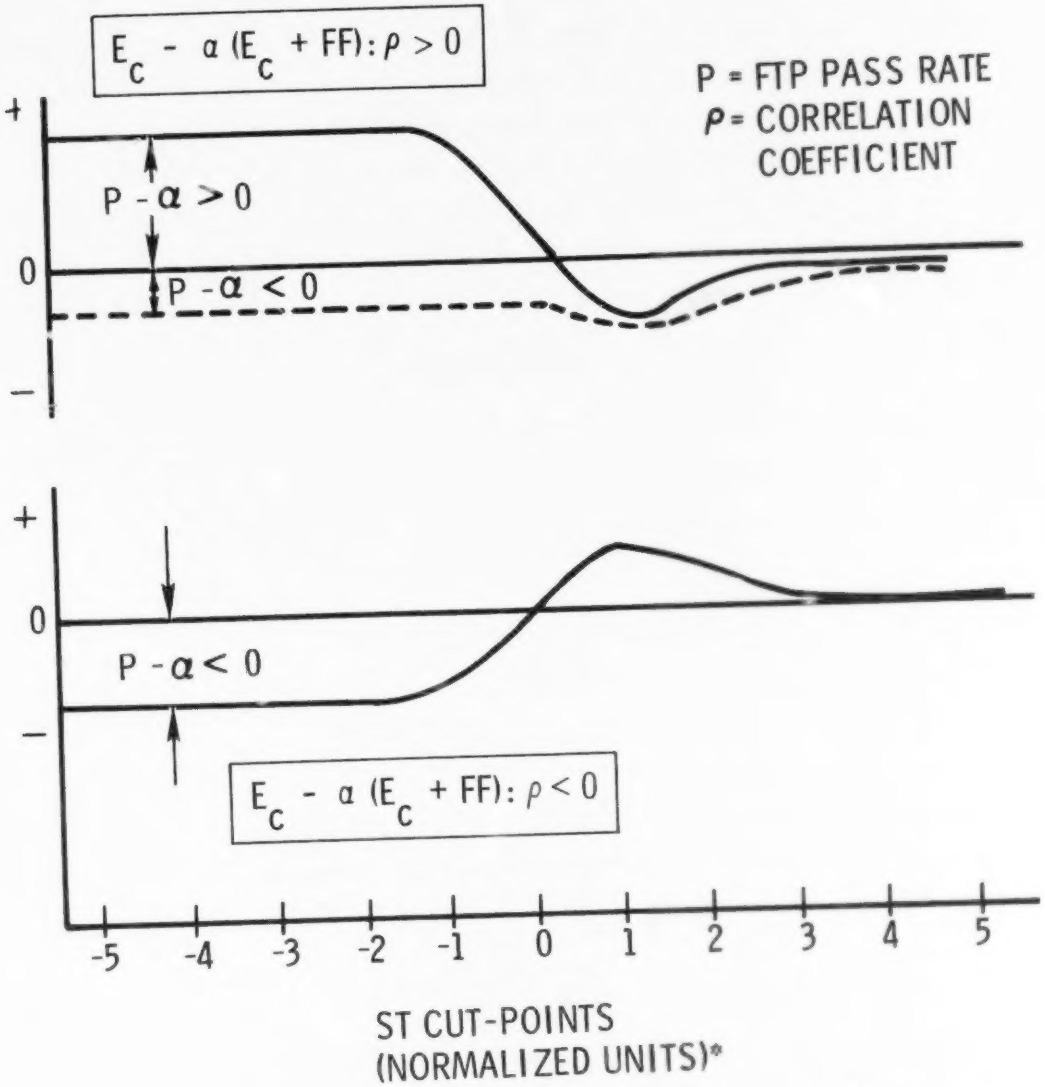
$$E_c - \alpha (E_c + FF) = 0 , \alpha > 0 \tag{3-2}$$

Since both E_c and $E_c + FF$ (the number of ST failures) are monotonically decreasing functions of the ST cut-point, the function $E_c - \alpha (E_c + FF)$ is not necessarily monotonic. This, then, admits the possibility of multiple solutions to Equation (3-2). In a situation where several solutions are found, the solution having the smallest value was taken, as this would have the minimum associated errors of omission.

A more serious difficulty is that Equation (3-2) may not possess any meaningful solutions. In the case where the ST/FTP data follow a bivariate normal or log-normal distribution, the conditions for the existence of a solution have been determined:

> for a positive correlation coefficient, the FTP pass rate must be greater than α; for a negative correlation coefficient, the FTP pass rate must be less than α; and for a zero correlation coefficient, the FTP pass rate must equal α.

This is illustrated in Figure 3-2 for positive and negative correlations. Intuitively, for $\rho > 0$, if the largest E_c (FTP passes) allowable is too small, then as the ST cut-point is increased from $-\infty$ (normalized units, zero in units of gm/mi or ppm), E_c will not overcome $\alpha (E_c + FF)$, in which case $E_c/(E_c + FF)$ will always be less than α. This becomes obvious as the FTP pass rate goes to zero, which is a situation that can be expected to occur, as the Denver analysis will demonstrate.



* IN UNITS OF THE ST STANDARD DEVIATION AFTER ADJUSTING FOR THE ST MEAN VALUE, I.E., AN ST CUT-POINT OF 1 WOULD BE EQUAL TO THE ST MEAN PLUS ONE STANDARD DEVIATION

Figure 3-2. $Ec - \alpha(Ec + FF)$ as a Function of ST Cut-Point

Even though a solution to Equation (3-2) is found, it may not be of practical importance. Many cases were encountered in which, although a solution existed and was found, the ST failure rate was extremely small, less than 1% of total, for example. Thus, a threshold was established for each pollutant on the ST failure rate. If the solution yielded a failure rate less than the threshold, the solution was categorized as having no practical importance. The threshold values are shown in the following table.

Pollutant	Threshold for ST Failure Rate (Percent of Total)
HC	1
CO	2
NO_x	0.5

Both parametric and non-parametric methods were employed. For the parametric solution, the equations shown in Figure 3-3 were solved. In the non-parametric approach, the cut-point is taken as the first measurement, rank ordered, for which

$$E_c - [\alpha (E_c + FF)] = 0 \qquad (3\text{-}3)$$

where [n] denotes the largest integer less than or equal to n.

3.1.3 Bounded Errors of Commission

The techniques used for estimating cut-points based upon a given E_c rate are described in Section 5.1 of Volume I.

Both parametric and non-parametric methods were employed. The parametric solution is found by solving the probability equations shown in Figure 3-4. For the non-parametric solution, the ST cut-point is

EC - α(EC+FF) = 0: Solve for C_2

$$\int_{-\infty}^{C_1}\int_{C_2}^{\infty} D(X_1, X_2)\, dX_1 dX_2 \; - \; \alpha\int_{-\infty}^{\infty}\int_{C_2}^{\infty} D(X_1, X_2)\, dX_1 dX_2 \; = \; 0$$

where

C_1 = FTP Standard
C_2 = ST Cut-Point
α = Policy Parameter
D(.,.) = Bivariate normal (or log-normal) density function as determined by the ST and FTP data

Figure 3-3. Equation for ST Cut-Point Determination; Ec/(Ec + FF) = α

Bounded Errors of Commission: Solve for C_2

$$\gamma = \int_{-\infty}^{C_1} \int_{C_2}^{\infty} D(X_1, X_2)\, dX_1 dX_2$$

where

C_1 = FTP Standard

C_2 = ST Cut-Point

γ = Maximum Allowable Probability of an Error of Commission

$D(.,.)$ = Bivariate normal (or log-normal) density function as determined by the ST and FTP data

Figure 3-4. Equation for ST Cut-Point Determination: $Ec = \gamma$

estimated by the ST measurement value having the smallest rank while not allowing the errors of commission to exceed the specified bound.

3.1.4 Fixed Short Test Effectiveness

The technique STE = α is equivalent to selecting the ST cut-point such that the percentage of FF vehicles equals α times the FTP failure rate:

$$FF = \alpha(E_o + FF); \quad 0<\alpha<1 \tag{3-4}$$

For a fixed FTP standard and pollutant, $(E_o + FF)$ takes the value of the estimated FTP failure rate. Thus, Equation (3-4) reduces to FF equaling a constant value. Since FF is a decreasing function of the ST cut-point, Equation (3-4) always yields a solution.

Both parametric and non-parametric methods were employed. The parametric equations are shown in Figure 3-5. The non-parametric method uses the ranking procedure previously described to achieve the following inequality:

$$\max FF \leq \alpha (E_o + FF) \tag{3-5}$$

3.2 VARIANCE ESTIMATES

The problem of computing the variance or equivalently the standard error of ST cut-point estimates is particularly important, since the standard error establishes the quality of the estimate. For an HC cut-point of 800 ppm with a standard error of 10 ppm, the cut-point has been determined to be 800 ppm ± 30 ppm with 95% confidence (95% confidence implies approximately 3 times the standard error). However, the same cut-point estimate having a standard error of 100 ppm cannot be determined to within 200 ppm with confidence greater than 90% (90% confidence is approximately twice the standard error).

Fixed Short Test Effectiveness: Solve for C_2

$$\int_{C_1}^{+\infty}\int_{C_2}^{+\infty} D(X_1,\ X_2)\ dX_1 dX_2 = \alpha \int_{-\infty}^{C_1}\int_{-\infty}^{\infty} D(X_1,\ X_2)\ dX_1 dX_2$$

where

C_i = FTP Standard

C_2 = ST Cut-Point

α = Desired Level for STE

$D(.,.)$ = Bivariate normal (or log-normal) density function as determined by the ST and FTP

Figure 3-5. Equation for ST Cut-Point Determination; STE = α

Methods were established to calculate the standard errors associated with the ST cut-point, E_c, E_o, FF, and PP for each pollutant. The procedures employed make use of the methodology established in Section 5.2.1 of Volume I. A complete discussion is, however, deferred to Section 5 on short test variability where other elements of error assessment are also discussed.

Standard error estimates for the contingency table percentages in a multiple-constituent test are discussed in Section 5.2.2 of Volume I. Table 104 of Volume I lists the standard errors as a function of sample size and the table percentages.

It is also important to know the relationships between sample size, estimation procedure, and the resulting standard errors so as to properly design experimental programs which will yield estimates with a desired precision and confidence. This is also discussed in Section 5 of this report.

3.3 CONTINGENCY TABLE ANALYSES AND RESULTS

Analyses of the four cities data were conducted on two separate vehicle fleets: Chicago, Houston, and Phoenix vehicles comprised the 300-car fleet, while Denver vehicles made up the 117-car fleet. Within each fleet the vehicles were stratified into three engine classes: CID 150 and less, CID 151 through 259, and CID 260 or greater. For each fleet, contingency table analyses were performed on each engine displacement group as well as the fleet as a whole. ST cut-points were calculated for each engine displacement class and for the pooled fleet, using the following cut-point selection techniques.

a) $E_c = 5\%$

b) STRR = 1.0

c) $\frac{E_c}{E_c + FF} = 10\%$ and 20%

d) STE = 60%, 70%, and 80%

For each analysis, the following statistics were reported and presented in the Appendix in tabular form.

a) Short test cut-point

b) E_c, E_o, and FF in percentages of total vehicles

c) Short test effectiveness, $FF/(E_o + FF)$

d) Short Test Rejection Ratio, $(E_c + FF)/(E_o + FF)$

e) $E_c/(E_c + FF)$

f) Table correlation index

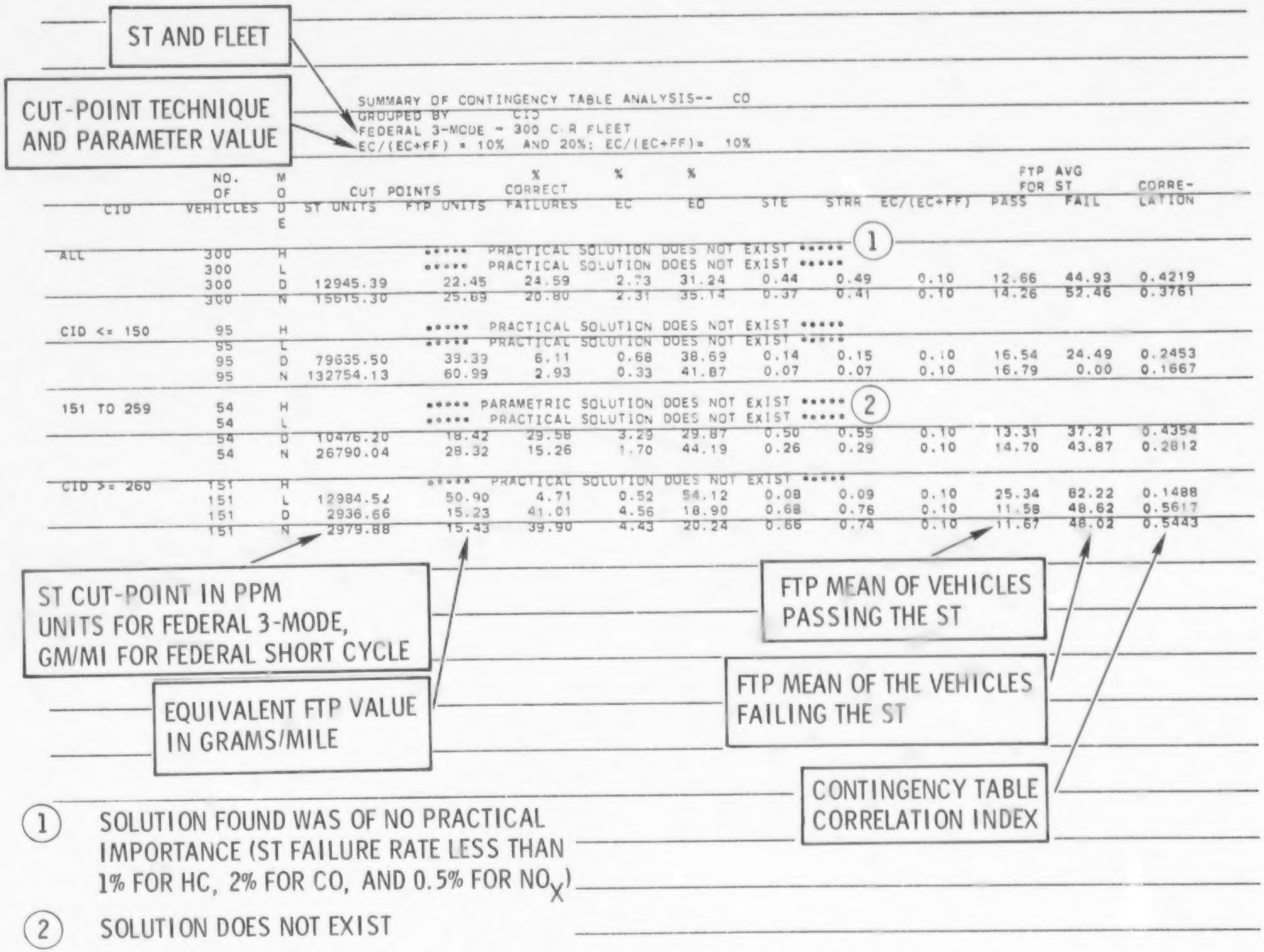
g) Mean FTP values of ST passing vehicles

h) Mean FTP values of ST failing vehicles

i) FTP values which correspond to the ST cut-points

Federal Short Cycle and Federal Three-mode short tests data were analyzed.

Shown in Figure 3-6 is a sample report of a contingency table analysis for CO. The ST, vehicle fleet, ST cut-point technique, and the value of the parameter for which the analysis was performed are designated in the table heading. The first three columns of the table indicate the CID group analyzed, number of vehicles in each group, and the ST mode. The "CUT-POINTS" column gives the value of the ST cut-point (units of ppm for the Federal Three-mode and units of grams/mile for the Federal Short Cycle) and the equivalent FTP value in grams/mile. (The equivalent FTP value was determined as the expected FTP value given the ST cut-point value; i.e., the conditional expectation was used as the regression function.) For example, the 151 to 259 CID group has a CO cut-point of 10476 ppm in the idle-in-drive mode, which corresponds to 18.4 grams/mile on the 75 FTP scale. Columns 6 through 11 give the predicted values for FF, E_c, E_o, STE, STRR, and $E_c/(E_c + FF)$. Columns 12 and 13, the "FTP AVG" columns, give the mean FTP values



```
                                SUMMARY OF CONTINGENCY TABLE ANALYSIS--  CO
                                GROUPED BY        CID
                                FEDERAL 3-MODE - 300 C.R FLEET
                                EC/(EC+FF) = 10%  AND 20%: EC/(EC+FF)=  10%

               NO.     M                               %         %        %                                      FTP AVG
               OF      O         CUT POINTS         CORRECT                                                       FOR ST       CORRE-
     CID     VEHICLES  D   ST UNITS   FTP UNITS   FAILURES      EC       EO      STE     STRR   EC/(EC+FF)   PASS    FAIL     LATION
                       E

  ALL           300    H                 ***** PRACTICAL SOLUTION DOES NOT EXIST ***** ①
                300    L                 ***** PRACTICAL SOLUTION DOES NOT EXIST *****
                300    D   12945.39     22.45      24.59       2.73     31.24    0.44     0.49      0.10      12.66   44.93    0.4219
                300    N   15615.30     25.69      20.80       2.31     35.14    0.37     0.41      0.10      14.26   52.46    0.3761

  CID <= 150     95    H                 ***** PRACTICAL SOLUTION DOES NOT EXIST *****
                 95    L                 ***** PRACTICAL SOLUTION DOES NOT EXIST *****
                 95    D   79635.50     39.39       6.11       0.68     38.69    0.14     0.15      0.10      16.54   24.49    0.2453
                 95    N  132754.13     60.99       2.93       0.33     41.87    0.07     0.07      0.10      16.79    0.00    0.1667

  151 TO 259     54    H                ***** PARAMETRIC SOLUTION DOES NOT EXIST ***** ②
                 54    L                 ***** PRACTICAL SOLUTION DOES NOT EXIST *****
                 54    D   10476.20     18.42      29.58       3.29     29.87    0.50     0.55      0.10      13.31   37.21    0.4354
                 54    N   26790.04     28.32      15.26       1.70     44.19    0.26     0.29      0.10      14.70   43.87    0.2812

  CID >= 260    151    H                 ***** PRACTICAL SOLUTION DOES NOT EXIST *****
                151    L   12984.52     50.90       4.71       0.52     54.12    0.08     0.09      0.10      25.34   82.22    0.1488
                151    D    2936.66     15.23      41.01       4.56     18.90    0.68     0.76      0.10      11.58   48.62    0.5617
                151    N    2979.88     15.43      39.90       4.43     20.24    0.66     0.74      0.10      11.67   48.02    0.5443
```

ST AND FLEET

CUT-POINT TECHNIQUE AND PARAMETER VALUE

ST CUT-POINT IN PPM UNITS FOR FEDERAL 3-MODE, GM/MI FOR FEDERAL SHORT CYCLE

EQUIVALENT FTP VALUE IN GRAMS/MILE

FTP MEAN OF VEHICLES PASSING THE ST

FTP MEAN OF THE VEHICLES FAILING THE ST

CONTINGENCY TABLE CORRELATION INDEX

① SOLUTION FOUND WAS OF NO PRACTICAL IMPORTANCE (ST FAILURE RATE LESS THAN 1% FOR HC, 2% FOR CO, AND 0.5% FOR NO_X)

② SOLUTION DOES NOT EXIST

Figure 3-6. Sample of Contingency Table Results

for the vehicles which pass and fail the short test. Thus, for the 151 to 259 CID group, the CO idle-in-drive test will fail vehicles with an average FTP level of 37.21 grams/mile. The last column contains the contingency table correlation index as defined in Table 1-2 of Volume I. For the cases where practical solutions are not found, appropriate messages have been printed. The meaning of the messages is footnoted.

The results are presented for each fleet first by pollutant and then by the multiple-constituent test results. The effects of engine displacement and cut-point selection technique which are described for each pollutant are summarized in separate sections. Finally, a comparison of the two fleets is made.

3.3.1 Analyses and Results for the 300-Car Fleet

3.3.1.1 Hydrocarbon Emission

The results for both ST are given in Tables 35 through 48 as follows.

ST Cut-point Selection Technique	Short Test Table Number	
	Federal Short Cycle	Federal Three-mode
STRR = 1.0	35	36
$E_c/(E_c + FF)$ = 10%	37	38
20%	39	40
E_c = 5%	41	42
STE = 0.60	43	44
0.70	45	46
0.80	47	48

a) STRR = 1.0: In the case of the Federal Short Cycle (Table 35), the STE value ranges from 0.64 to 0.74 for the CID groups and is 0.72 for the pooled fleet. The cut-points vary slightly between CID groups with all the FTP equivalent cut-points below the FTP standard of 1.5 grams/mile. The difference between FTP means and ST passing and failing vehicles ranges from 0.8 to 1.6 grams/mile for the CID groups and is 1.3 grams/mile for the pooled fleet.

For the Federal Three-mode ST (Table 36), the idle-in-drive mode uniformly has the highest STE value which ranges from 0.53 to 0.65 for the CID groups and is 0.60 for the pooled fleet. The idle-in-drive ST cut-point varies from 97 to 138 ppm for the CID groups and is 112 ppm for the pooled fleet. The equivalent FTP value of the ST cut-point is consistently below 1.5 grams/mile. Similar trends are present in the FTP means for ST passing and failing vehicles as described for the Federal Short Cycle.

The errors of commission are typically 9% for the Federal Short Cycle and 13% for the Federal Three-mode. The ratio $E_c/(E_c + FF)$ was about 0.3 for the Federal Short Cycle and about 0.5 for the Federal Three-mode.

b) $E_c/(E_c + FF) = 0.1$ and 0.2: The STE and STRR value was generally higher at the parametric value 0.2 than at 0.1 (Tables 37 to 40).

For the Federal Short Cycle, STE ranged from 0.16 to 0.40 at 0.10 and 0.35 to 0.63 at 0.20. Similar behavior is observed in the STRR value; i.e., 0.18 to 0.45 at 0.1 and 0.44 to 0.78 at 0.2. Errors of commission were typically in the neighborhood of 1% at 0.1 and 4% at 0.2 for the Federal Short Cycle.

In the case of the Federal Three-mode, the parameter value of 0.1 was too low to yield cut-points of practical importance. The parameter value of 0.2 yielded ST cut-points for the idle-in-drive mode with typical STE and STRR of 0.2 and 0.2, respectively. The E_c rate was approximately 1 to 2 percent.

c) E_c = 5%: The STE value for the Federal Short Cycle ranges from 0.49 to 0.62 on the CID groups, with 0.67 to 0.77 the corresponding STRR range. $E_c/(E_c + FF)$ was generally about 0.2 (Table 41).

For the Federal Three-mode, the idle-in-drive mode was uniformly superior on the basis of STE which ranged from 0.31 to 0.44. The associated STRR varied from 0.47 to 0.60, and $E_c/(E_c + FF)$ was generally about 0.3 (Table 42).

d) STE = 0.6, 0.7, and 0.8: As the STE parameter value increases, the ST cut-point decreases, which increases E_c, STRR, and $E_c/(E_c + FF)$.

For the Federal Short Cycle, the fleet STRR value ranges from 0.77 to 1.20 as STE is varied from 0.6 to 0.8. The corresponding ranges of E_c and $E_c/(E_c + FF)$ are 5.3% to 13.2% and 0.22 to 0.34, respectively. The 151 to 259 CID group had higher E_c, STRR, and $E_c/(E_c + FF)$ than the other two groups and the fleet average (Tables 43, 45, and 47).

The Federal Three-mode ST results show the idle-in-drive mode to be superior than other modes in the following respect: for each value of STE, E_c and $E_c/(E_c + FF)$ were simultaneously the lowest among modes while maintaining relatively high STRR values. The fleet value for STRR ranges from 1.0 to 1.60, from 12.7% to 25.3% for E_c, from 0.40 to 0.50 for $E_c/(E_c + FF)$ as STE is varied from 0.60 to 0.80. The trends among CID groups are similar to those indicated for the Federal Short Cycle (Tables 44, 46, and 48).

3.3.1.2 Carbon Monoxide Emission

The results for both ST are given in Tables 49 through 62 as follows.

ST Cut-point Selection Technique	Short Test Table Number	
	Federal Short Cycle	Federal Three-mode
STRR = 1.0	49	50
$E_c/(E_c + FF) = 10\%$	51	52
20%	53	54
$E_c = 5\%$	55	56
STE = 0.60	57	58
0.70	59	60
0.80	61	62

a) STRR = 1.0: In the case of the Federal Short Cycle ST (Table 49), the STE values range from 0.75 to 0.85 for the CID groups and the value is 0.82 for the pooled fleet. The ST cut-point for the 150 CID and less group is twice as large as the cut-point for the other groups, thus producing relatively high values of E_c (11.2%) and $E_c/(E_c + FF)$ (0.25) for the 150 CID and less group. This group had the lowest value of STE (0.75).

The Federal Three-mode ST results (Table 50) show the idle-in-drive mode to be uniformly the best in terms, maximizing STE while minimizing E_c and $E_c/(E_c + FF)$. Idle-in-drive STE values ranged from 0.68 to 0.83, while the pooled fleet value was 0.78. Typical E_c and $E_c/(E_c + FF)$ were 12% and 0.22, respectively. The ST cut-points for the idle-in-drive mode decrease, 5900 ppm to 1100 ppm, with increasing engine displacement group. Hence, the trends noted in the Federal Short Cycle results are present in the Federal Three-mode results.

b) $E_c/(E_c + FF) = 0.1$ and 0.2: The STE and STRR values were generally higher at the parameter value 0.2 than at the value 0.1 (Tables 51 to 54).

For the Federal Short Cycle ST, STE ranged from 0.39 to 0.77 at 0.10 and 0.65 to 0.92 at 0.20. The corresponding STRR values varied from 0.44 to 0.85 at 0.1 and 0.81 to 1.15 at 0.2. The 150 CID and less group had the lowest values of STE and STRR at each parameter setting. The E_c rate was lowest for the 150 CID and less group, with 2% at 0.1 and 7% at 0.2. The E_c fleet average was 3.8% at 0.1 and 11.4% at 0.2.

In the case of the Federal Three-mode ST, the idle-in-drive mode had the highest values of STE and STRR at each parameter setting. The pooled fleet values of STE and STRR were respectively 0.44 and 0.49 at 0.1 and respectively 0.73 and 0.91 at 0.2. The 150 CID and less group had the lowest STE and STRR value among the CID groups.

c) $E_c = 5\%$: The STE value for the Federal Short Cycle ranges from 0.57 to 0.77 on the CID groups with 0.68 to 0.86 the associated STRR range. $E_c/(E_c + FF)$ was typically about 0.1 (Table 55).

The Federal Three-mode ST (Table 56) results show the idle-in-drive to be uniformly superior on the basis of STE and STRR which range from 0.41 to 0.70 and 0.52 to 0.79, respectively. $E_c/(E_c + FF)$ was generally about 0.14.

For both ST, the 150 CID and less group showed the lowest STE and STRR values.

d) STE = 0.6, 0.7, and 0.8: For the Federal Short Cycle (Tables 57, 59, and 61), the fleet STRR value ranges from 0.66 to 0.96 as STE is varied from 0.6 to 0.8. The corresponding ranges of E_c and $E_c/(E_c + FF)$ are 3% to 11% and 0.09 to 0.17, respectively.

The Federal Three-mode ST results (Tables 58, 60, and 62) show the idle-in-drive mode to be superior to the other modes in that for each value of STE, E_c and $E_c/(E_c + FF)$ were simultaneously the lowest among modes while maintaining relatively high STRR values. The fleet value for STRR ranged from 0.71 to 1.04, from 5.9% to 13.4% for E_c, and from 0.15 to 0.23 for $E_c/(E_c + FF)$ as STE was varied from 0.60 to 0.80.

For both ST, the 150 CID and less group showed a lower level of STRR and higher levels of E_c and $E_c/(E_c + FF)$ than the other CID groups.

3.3.1.3 Oxides of Nitrogen Emission

The results for both ST are shown in Tables 63 through 76 as follows.

ST Cut-point Selection Technique	Short Test Table Number	
	Federal Short Cycle	Federal Three-mode
STRR = 1.0	63	64
$E_c/(E_c + FF)$ = 10%	65	66
20%	67	68
E_c = 5%	69	70
STE = 0.60	71	72
0.70	73	74
0.80	75	76

a) STRR = 1.0: In the case of the Federal Short Cycle ST (Table 63), the pooled fleet STE value is 0.67, with a corresponding E_c of 6.9% and $E_c/(E_c + FF)$ of 0.33.

For the Federal Three-mode ST (Table 64), the high speed was superior for the CID groups except for the 151 to 259 CID group, for which the low-speed mode was favorable. Superiority was measured on the basis of high STE, low E_c, and low $E_c/(E_c + FF)$. The average STE is about 0.54, with a corresponding E_c rate of about 9%.

In general, only slight variations between CID groups were observed for both ST.

b) $E_c/(E_c + FF) = 0.1$ and 0.2: The Federal Short Cycle ST results (Tables 65 and 67) show the STE and STRR fleet values to be respectively 0.27 and 0.30 at 0.1 and respectively 0.46 and 0.58 at 0.2. The corresponding E_c rates are 0.6% at 0.1 and 2.5% at 0.2. Only slight variation in the STE and STRR values for the CID groups were observed.

Practical solutions for the Federal Three-mode ST were generally not found (Tables 66 and 68). The maximum STE was 0.19 and maximum STRR was 0.23.

c) $E_c = 5\%$: The STE value for the Federal Short Cycle ST (Table 69) ranges from 0.54 to 0.63 for theCID groups with 0.74 to 0.95 the corresponding STRR range. $E_c/(E_c + FF)$ was generally about 0.3.

In the case of the Federal Three-mode ST (Table 70), the high-speed mode was superior, on the basis of STE and STRR, for the 150 CID and less group and the 260 CID and greater group. The low-speed mode was best for the 151 to 259 CID group. The STE value ranges from 0.34 to 0.44 on the CID groups and is 0.31 for the pooled fleet. STRR ranged from 0.54 to 0.74 on CID groups, with 0.55 as the fleet value.

Generally, STRR and STE decreased with increasing engine displacement in both of the ST results.

d) STE = 0.6, 0.7, and 0.8: For the Federal Short Cycle (Tables 71, 73, and 75), the fleet STRR value ranges from 0.83 to 1.38 as STE varies from 0.6 to 0.8. The corresponding ranges of E_c and $E_c/(E_c + FF)$ are 4.9% to 12.3% and 0.28 to 0.42, respectively.

The Federal Three-mode ST results (Tables 72, 74, and 76) show the low-speed mode to be superior on the 151 to 259 CID group and the high-speed mode to be superior on the remaining CID groups. The fleet values of STRR, E_c, and $E_c/(E_c + FF)$ range from 1.38 to 2.29, 16.5% to 31.4%, and 0.57 to 0.65, respectively.

Slight variation between CID group values of STRR, E_c, and $E_c/(E_c + FF)$ are judged to be statistically non-significant.

3.3.1.4 Multiple Constituent Tests

The results for both ST are given in Tables 77 through 90 as follows.

ST Cut-point Selection Technique	Short Test Table Number	
	Federal Short Cycle	Federal Three-mode
STRR = 1.0	77	78
$E_c/(E_c + FF)$ = 10%	79	80
20%	81	82
E_c = 5%	83	84
STE = 0.60	85	86
0.70	87	88
0.80	89	90

In the case of the Federal Three-mode, the "best" mode combination used was HC and CO at idle-in-drive, and NO_x at high speed, which was selected on the basis of the pooled fleet correlation coefficients.

a) STRR = 1.0: In the case of the Federal Short Cycle ST (Table 77), the STE values ranged from 0.82 to 0.95 for the CID groups. The associated STRR values ranged from 1.00 to 1.14. E_c and $E_c/(E_c + FF)$ were typically 12% and 0.18.

For the Federal Three-mode ST (Table 78), the "best" mode produced the lowest level of E_c (7% to 13% on the CID groups), while maintaining relatively high STE (0.78 to 0.83) and STRR (0.93 to 1.02). The idle-in-drive mode generally had a slightly higher value of STE (0.78 to 0.86) and STRR (1.03 to 1.05) at the expense of increased E_c (13.3% to 15.8%).

b) $E_c/(E_c + FF) = 0.1$ and 0.2: Practical ST cut-points were produced only for the case of Federal Short Cycle ST. The pooled fleet values of E_c, STE, STRR, and $E_c/(E_c + FF)$ were 2.3%, 0.69, 0.72, and 0.05 at 0.1 and 10.7%, 0.90, 1.06, and 0.15 at 0.2 (Tables 79 to 82).

c) $E_c = 5\%$: The STE value for the Federal Short Cycle ST (Table 83) ranges from 0.76 to 0.90 on the CID groups with 0.78 to 1.02 the corresponding STRR range. The pooled fleet E_c was 7%.

For the Federal Three-mode ST (Table 84), the "best" mode was preferable with regard to lowest E_c at the expense of slightly decreased STE and STRR value from the maximum level which was attained on the idle-in-drive mode. STE varied from 0.51 to 0.71 for the CID groups for the best mode, while STRR values ranged from 0.60 to 0.77. E_c was generally about 4% on the "best" mode.

d) STE = 0.6, 0.7, and 0.8: For the Federal Short Cycle ST (Tables 85, 87, and 89), the fleet STE value ranged from 0.76 to 0.92 as the STE parameter was varied from 0.6 to 0.8. The corresponding range for STRR was 0.82 to 1.14, for E_c was 4% to 14%, and was 0.07 to 0.19 for $E_c/(E_c + FF)$.

In the case of the Federal Three-mode ST (Tables 86, 88, and 90). STE values ranged from 0.77 to 0.92 on the "best" mode for the pooled fleet as the STE parameter was varied from 0.6 to 0.8. The corresponding STRR and E_c ranges were 0.94 to 1.22 and 11% to 20%, respectively. On the idle modes, STE was 0.83 to 0.96, STRR was 0.94 to 1.45, and E_c was 19% to 32%. $E_c/(E_c + FF)$ ranged from 0.18 to 0.34 on the pooled fleet.

3.3.1.5 Discussion of 300-Car Fleet Results

In general, decreasing the value of the ST cut-point for a particular pollutant will increase the levels of E_c, FF, and $E_c + FF$ (the ST failure rate). Notice that once the vehicle group is determined, $E_o + FF$ (FTP failure rate) is determined, since the FTP standards are fixed at 1.5 grams/mile HC, 15.0 grams/mile CO, and 3.1 grams/mile NO_x. Alternatively, as any one of E_c, FF, E_c + FF increases, so will the others. Thus, low values of the ST cut-point will produce high values for E_c, STE, and STRR, whereas high values of the ST cut-point will produce low levels of E_c, STE, and STRR. These facts and relationships are fundamental in understanding and comparing the ST cut-point selection techniques.

As an example, application of the technique STRR = 1.0 for a given pollutant results in the maximum level of E_c and of STE allowable under the constraint that the ST failure rate does not exceed the FTP failure rate. In the case of the Federal Short Cycle ST, these maxima were 9.8% E_c and 0.82 STE for CO on the pooled fleet. For the Federal Three-mode ST, the corresponding maxima were 12.4% E_c and 0.78 STE for CO idle-in-drive on the pooled fleet. Hence, if STRR is constrained to a maximum of 1.0, the Federal Three-mode ST will not allow the CO idle-in-drive STE value to be greater than 0.78. Further, any ST cut-point selected to yield STE larger than 0.78 will result in STRR being larger than 1.0 and E_c larger than 12.4%.

The ST cut-points are summarized in Tables 91 and 92 for the pooled 300-car fleet for the Federal Short Cycle ST and the Federal Three-mode ST. These tables allow the techniques to be compared for each pollutant by ranking the ST cut-point values in descending order. Hence, for the Federal Short Cycle, the smallest CO cut-point of 4.51 grams/mile will have rank 7, whereas the largest CO cut-point of 11.25 grams/mile will have rank 1. The higher the rank the higher the E_c, STE, and STRR. For the previous illustration, E_c, STE and STRR were 11.4%, 0.85, and 1.06, respectively for the rank 7 cut-point, and were 3.1%, 0.60, and 0.66, respectively, for the rank 1 cut-point. Tables 93 and 94 show the technique ranks for each pollutant of the pooled fleet. The rank patterns are similar for both ST, which demonstrates a degree of invariance with respect to the measuring methods.

Theoretically, as the ST cut-point is decreased, the FTP average emission for both the ST passing and failing vehicles will decrease (providing the ST/FTP correlation is positive). As cut-point values tend to zero, the mean of the ST passing vehicles tends to zero, and the mean of the ST failing vehicles tends to the population mean. As the cut-point values tend to infinity, the mean of the ST passing vehicles tends to the population mean, and the mean of the ST failing vehicles theoretically tends to infinity. The minimum difference between the means of the ST failing vehicles and ST passing vehicles is non-negative and is less than or equal to the population mean. The maximum difference is theoretically unbounded.

For the 300-car fleet, these differences averaged about 1.25 grams/mile HC, 28.0 grams/mile CO, and 1.37 grams/mile NO_x in the case of the Federal Short Cycle, and about 1.05 grams/mile HC, 14.0 grams/mile CO, and 0.73 gram/mile NO_x in the case of the Federal Three-mode. Although this difference between the means of the ST passing and failing vehicles gives an indication of the expected reduction in emissions, it does not account for the differing number of vehicles in the passing and failing categories, nor does it account for credits due to corrective maintenance, each of which may substantially alter the eventual air quality benefits of a 207(b) program.

3.3.1.6 Parametric Variations

Figures 3-7 through 3-9 illustrate respectively the variation of the cut-point parameters for HC, CO, and NO_x, using the better modes of the Federal Three-mode ST for the 300-car pooled fleet. The results for the Federal Short Cycle are shown in Figures 3-11 through 3-13.

Each figure relates the variation of STRR, STE, E_c, and $E_c/(E_c + FF)$ to cut-point value. The specific cut-point techniques noted above (STRR = 1.0, $E_c = 5\%$, $E_c/(E_c + FF) = 0.1$ and 0.2, and STE = 0.6, 0.7, and 0.8) are delineated by black circles on the figures. As can be seen, for each pollutant test, there is no consistent variation of the results

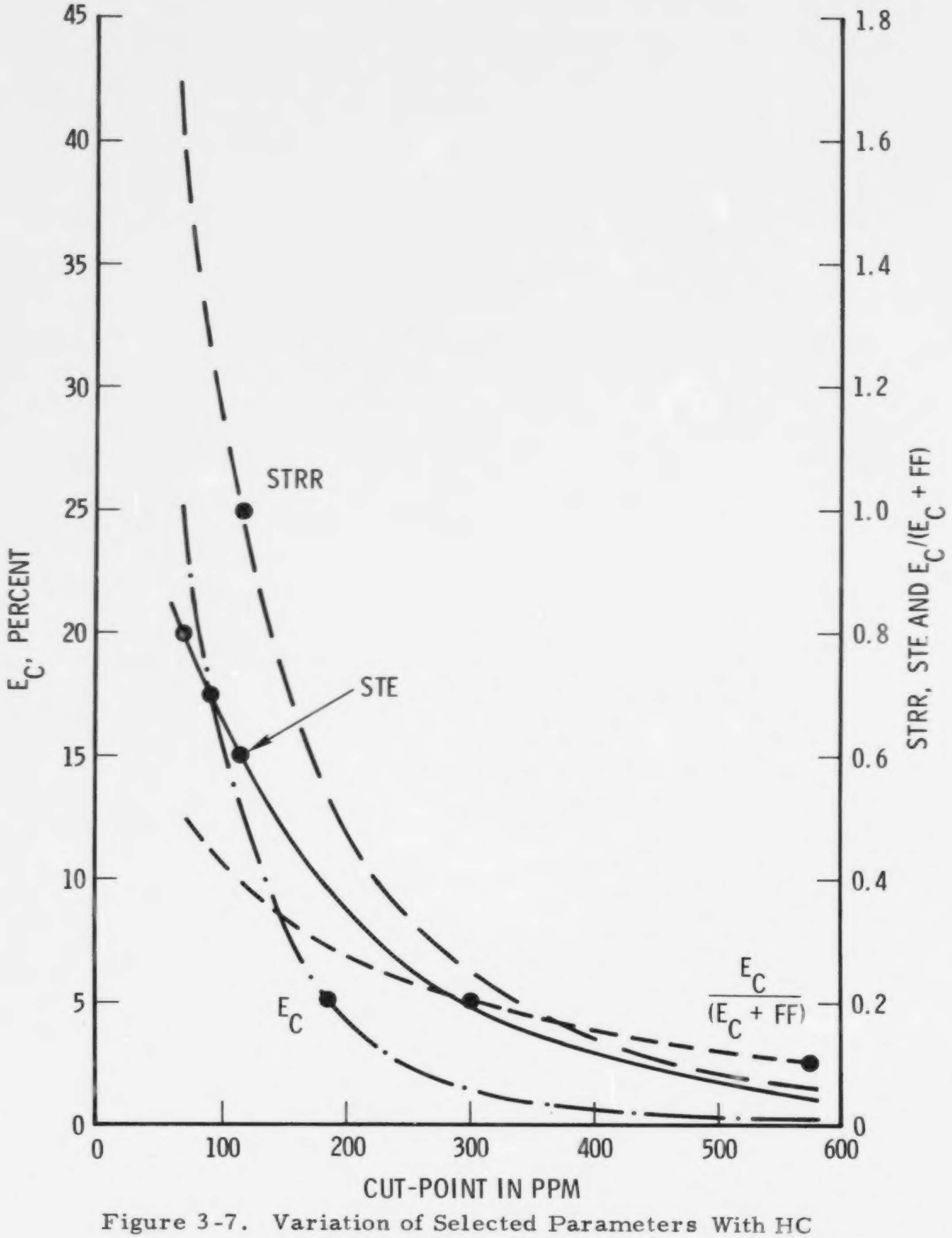


Figure 3-7. Variation of Selected Parameters With HC Cut-Point; 300 Car Fleet; Federal Three-Mode ST; Idle in Drive Mode

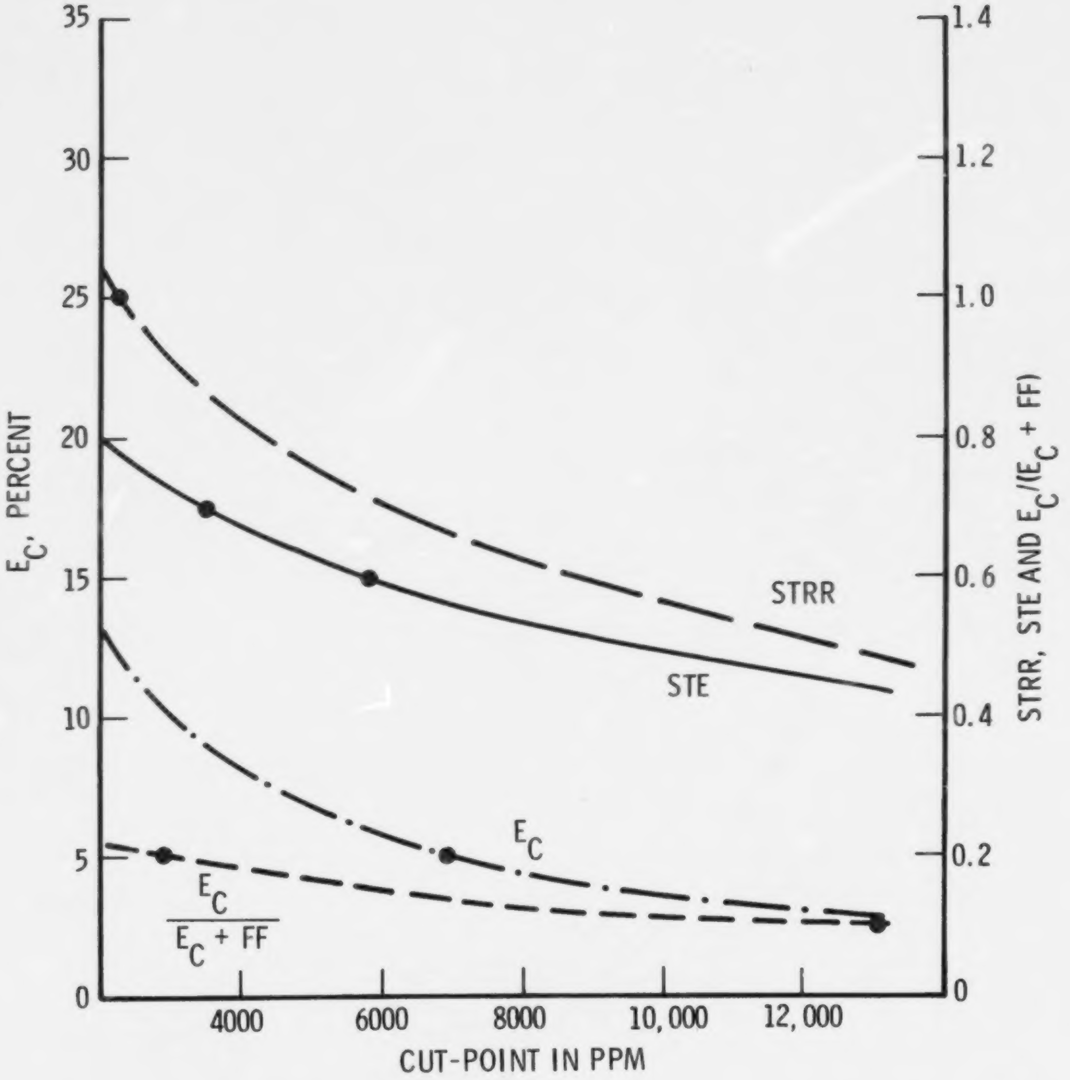


Figure 3-8. Variation of Selected Parameters With CO Cut-Point; 300 Car Fleet; Federal Three-Mode ST; Idle in Drive Mode

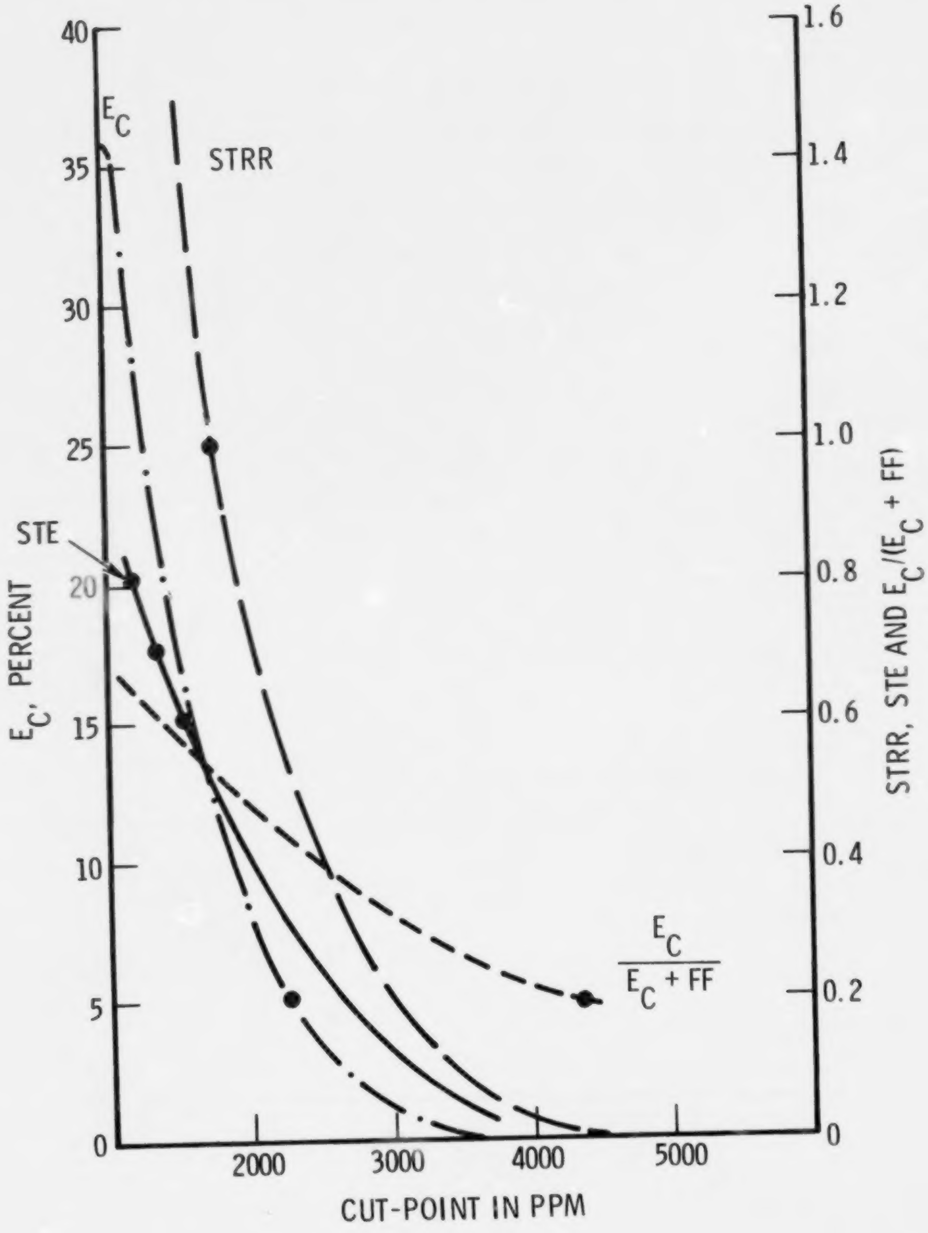


Figure 3-9. Variation of Selected Parameters With NO_x Cut-Point; 300 Car Fleet; Federal Three-Mode ST; High-Speed Mode

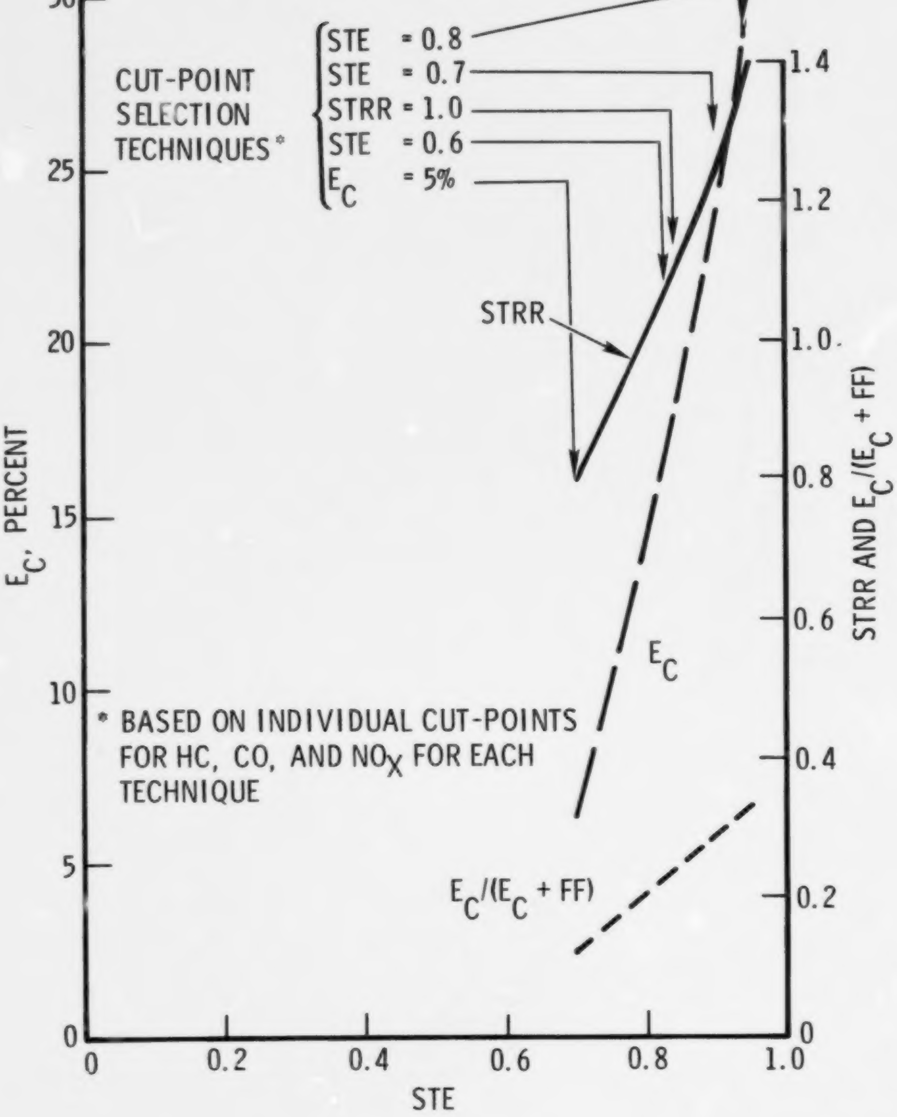


Figure 3-10. Variation of Selected Parameters With STE on Multiple Constituents Test; 300 Car Fleet; Federal Three-Mode ST; Idle in Drive Mode

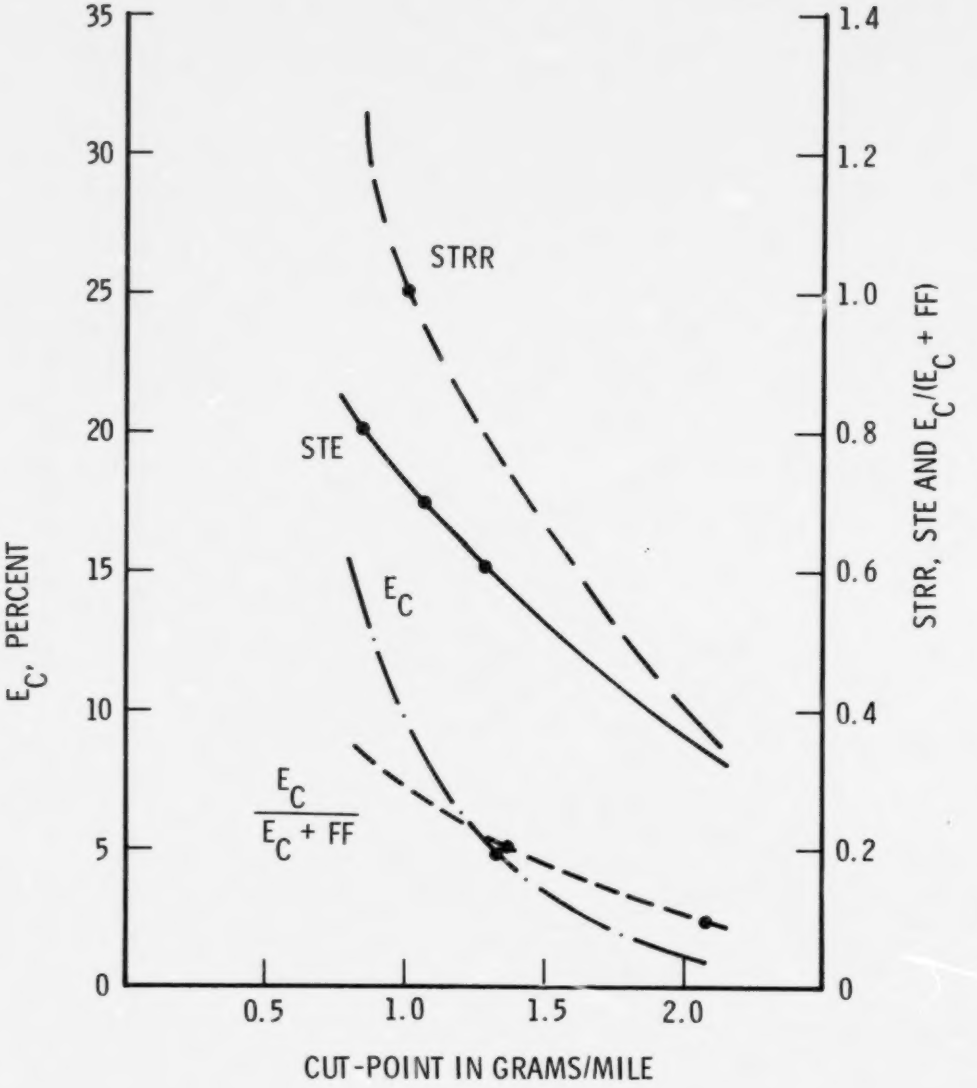


Figure 3-11. Variation of Selected Parameters With HC Cut-Point; 300 Car Fleet; Federal Short Cycle ST

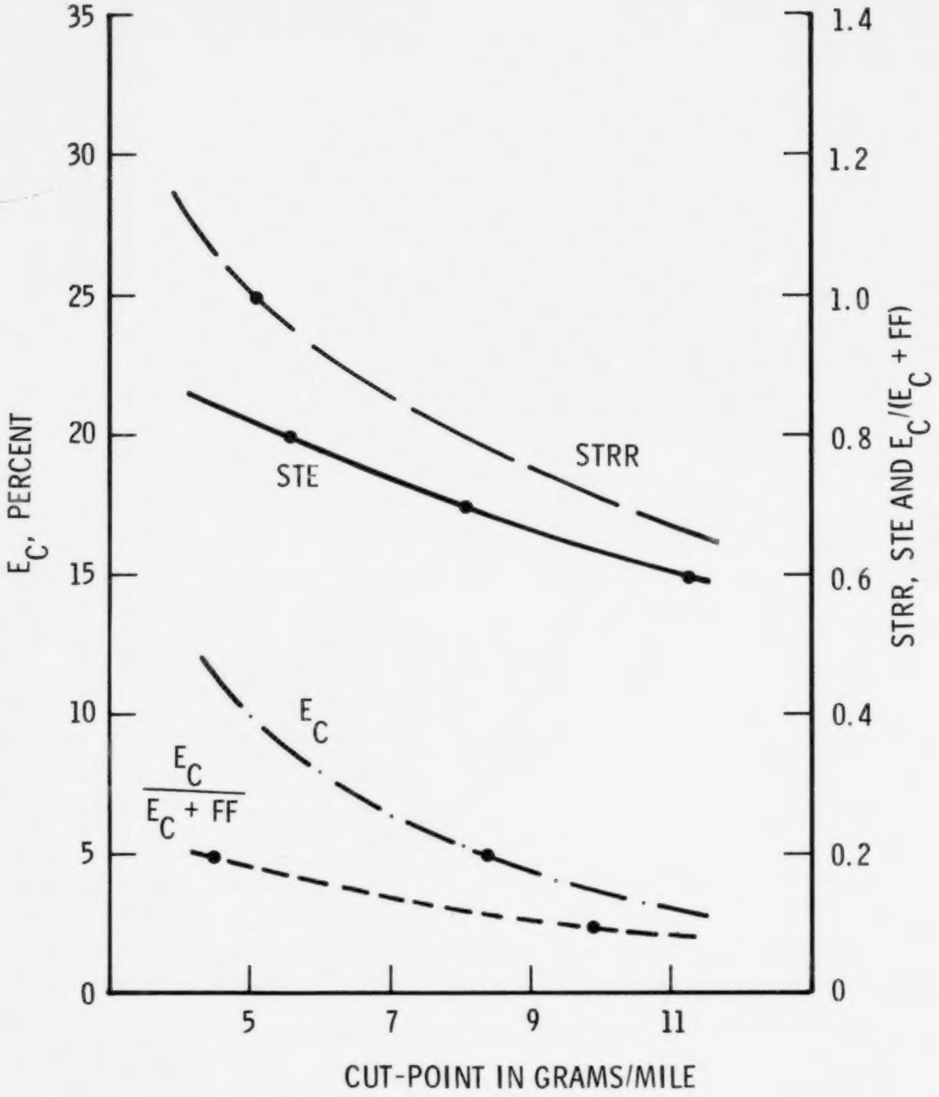


Figure 3-12. Variation of Selected Parameters With CO Cut-Point; 300 Car Fleet; Federal Short Cycle ST

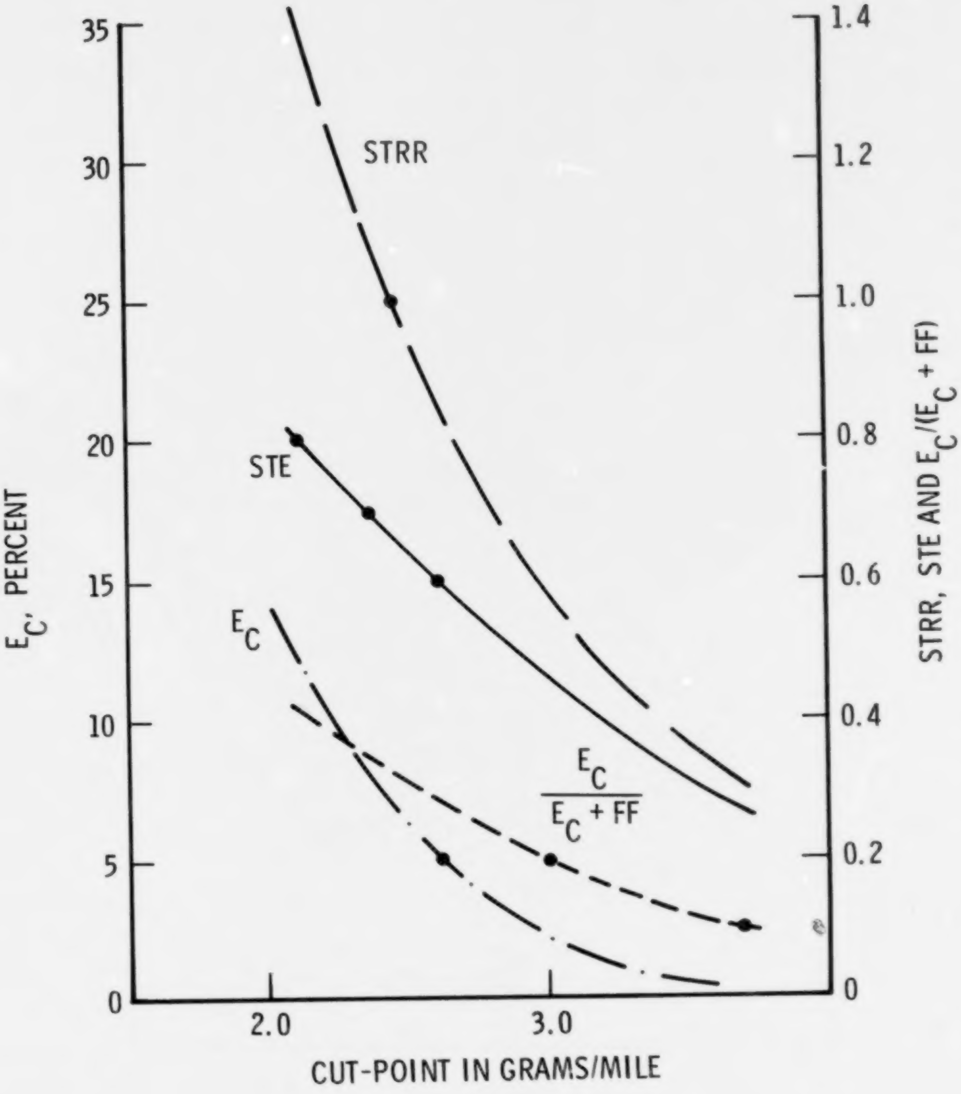


Figure 3-13. Variation of Selected Parameters With NO_x Cut-Point; 300 Car Fleet; Federal Short Cycle ST

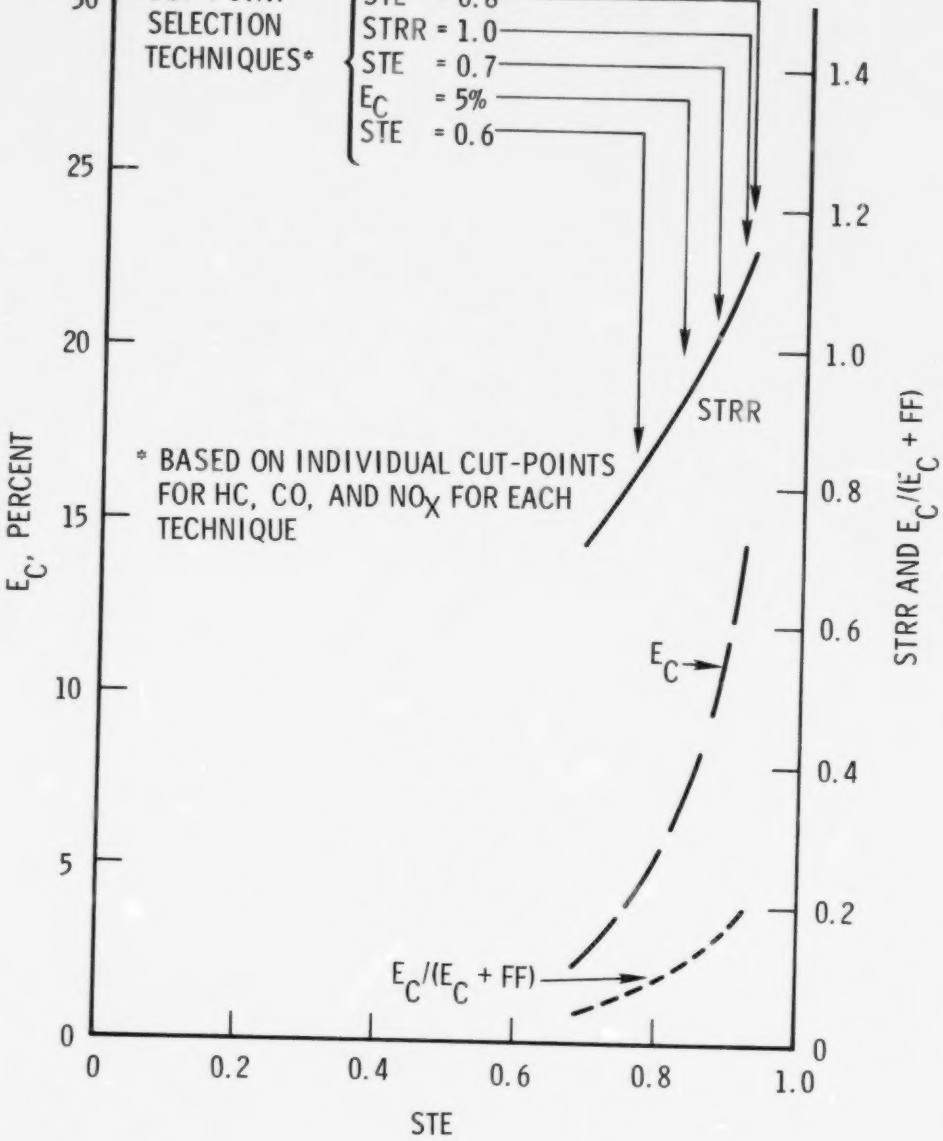


Figure 3-14. Variation of Selected Parameters With STE on Multiple Constituents Test; 300 Car Fleet; Federal Short Cycle

of the techniques STRR = 1.0, E_c = 5%, $E_c/(E_c + FF)$ = 0.1 or 0.2, and STE = 0.6, 0.7, or 0.8. Of these techniques, STRR = 1.0 consistently produces the highest STE values if the constraint is imposed that it would be undesirable to fail more cars with the ST than failed the FTP.

It would thus appear desirable to use the STRR parameter as the basis for selecting the ST cut-points for each pollutant. The other parameters are then uniquely determined for each vehicle test group and pollutant. The remaining policy decision would be the value of STRR to use in cut-point determination. Although a value of 1.0 was used in the present analysis, values less than 1.0 could be used as well, depending upon the needs of the inspection program to be implemented.

The multiple-constituent test results are shown in Figures 3-10 and 3-14 for the Federal Three-mode idle-in-drive and the Federal Short Cycle, respectively. Each of these figures relates the variation of STRR, E_c, and $E_c/(E_c + FF)$ to STE.

3.3.2 Analyses and Results for the 117-Car Fleet

3.3.2.1 Hydrocarbon Emission

The results for both ST are shown in Tables 95 through 108, as follows.

ST Cut-point Selection Technique	Short Test Table Number	
	Federal Short Cycle	Federal Three-mode
STRR = 1.0	95	96
$E_c/(E_c + FF)$ = 10%	97	98
20%	99	100
E_c = 5%	101	102
STE = 0.60	103	104
0.70	105	106
0.80	107	108

a) STRR = 1.0: In the case of the Federal Short Cycle ST (Table 95), the STE value ranges from 0.75 to 0.90 for the CID groups and is 0.87 for the pooled fleet. E_c and $E_c/(E_c + FF)$ were generally about 9% and 0.13, respectively.

For the Federal Three-mode ST (Table 96), the E_c, $E_c/(E_c + FF)$, and STE pooled fleet values varied only slightly between modes, so that no mode could be singled out as giving the highest parameter values. For the CID groups on the basis of STE value, the low-speed mode is best for the two smaller engine groups, while the idle-in-neutral appears best for the 260 CID and greater group. The other modes are, however, quite similar in STE value and the associated level of E_c and $E_c/(E_c + FF)$. A typical STE value is about 0.8, 13% for E_c, and 0.2 for $E_c/(E_c + FF)$. The 260 CID and greater group had the largest STE value (0.86) with the 151 to 259 CID group having the smallest (0.78).

In general, the performance of both ST was weaker for the 151 to 259 CID group than for the other groups. However, this group contains 18 vehicles, which subjects the group estimates to rather high degrees of uncertainty; i.e., large standard error of the estimate.

b) $E_c/(E_c + FF) = 0.1$ and 0.2: For the Federal Short Cycle ST (Tables 97 and 99), the STE value ranged from 0.33 to 0.89 at the parameter setting 0.1 and from 0.63 to 0.99 at 0.2. Similarly, the STRR values ranged from 0.37 to 0.99 at 0.1 and 0.79 to 1.24 at 0.2. Errors of commission were typically 6% at 0.1 and 16% at 0.2.

In the case of the Federal Three-mode (Tables 98 and 100), the parameter value of 0.1 was too low to yield a practical ST for the 151 to 259 CID group. For the pooled fleet, however, the low-speed mode was slightly higher in both STE and STRR values (0.48 and 0.53, respectively) than for the idle-in-neutral mode. For the parameter value 0.2, these values nearly doubled. The trend in "best" mode for CID groups is the same as above in paragraph 3.3.2.1a.

c) E_c = 5%: The STE value for the Federal Short Cycle ranges (Table 101) from 0.50 to 0.84 on the CID groups with 0.60 to 0.91 the corresponding STRR range. $E_c/(E_c + FF)$ was generally about 0.10. The 151 to 259 CID group yielded the lowest combined STE and STRR values, 0.50 and 0.60, respectively.

For the Federal Three-mode ST (Table 102), the STE value ranges from 0.47 to 0.74 on the best mode for each CID group. Corresponding STRR values were 0.54 to 0.81. "Best" mode and CID group trends are the same as discussed in 3.3.2.1a.

d) STE = 0.6, 0.7, and 0.8: The pooled fleet STRR values for the Federal Short Cycle ST (Tables 103, 105, and 107) ranged from 0.63 to 0.88 as STE was varied from 0.6 to 0.8. The corresponding ranges of E_c and $E_c/(E_c + FF)$ were 1.7% to 5.7% and 0.04 to 0.09, respectively. The 151 to 259 CID group had higher E_c, STRR, and $E_c/(E_c + FF)$ than did the other two CID groups.

In the case of the Federal Three-mode ST (Tables 104, 106, and 108), mode superiority is not strongly indicated by the results. The STRR value typically was 0.7 to 1.00 as STE was varied from 0.6 to 0.8. The 151 to 259 CID group generally displayed higher levels of E_c and $E_c/(E_c + FF)$ for a fixed value of STE.

3.3.2.2 Carbon Monoxide Emission

The results for both ST are given in Tables 109 through 122 as follows.

ST Cut-point Selection Technique	Short Test Table Number	
	Federal Short Cycle	Federal Three-mode
STRR = 1.0	109	110
$E_c/(E_c + FF) = 10\%$	111	112
20%	113	114
$E_c = 5\%$	115	116
STE = 0.60	117	118
0.70	119	120
0.80	121	122

a) STRR = 1.0: In the case of the Federal Short Cycle ST (Table 109), the STE values range from 0.92 to 0.97 for the CID groups and is 0.96 for the pooled fleet. The 260 CID and greater group showed lower levels of E_c (2.6%)and $E_c/(E_c + FF)$ (0.03) than the other engine displacement groups.

For the Federal Three-mode ST (Table 110), the idle modes have slightly higher STE values than the other modes. The range of STE values by CID group is 0.91 to 0.96. The E_c and $E_c/(E_c + FF)$ values (4% and 0.04, respectively) for the 151 to 259 CID group were about half those of the other CID groups. The ST cut-points for the idle-in-drive mode decreases from 1900 ppm to 300 ppm with increasing engine displacement group.

b) $E_c/(E_c + FF) = 0.1$ and 0.2: No solutions exist for the parameter setting 0.2, since the predicted FTP pass rate is less than 16% on all groups. Isolated solutions existed for the parameter value of 0.10, however, no practical ST would result (see Tables 111 to 114).

c) $E_c = 5\%$: The STE value (Table 115) for the Federal Short Cycle ranges from 0.88 to 1.00 on the CID groups, with 0.94 to 1.05 the associated STRR range. $E_c/(E_c + FF)$ was typically about 0.06.

The Federal Three-mode ST idle modes (Table 116) were slightly superior on the basis of STE and STRR which ranged from 0.87 to 0.99 and 0.93 to 1.04, respectively. $E_c/(E_c + FF)$ was generally about 0.06.

For both ST, the 151 to 259 CID and less group showed the lowest STE and STRR values.

d) STE = 0.6, 0.7, and 0.8: For the Federal Short Cycle ST (Tables 117, 119, and 121), the fleet STRR value ranges from 0.60 to 0.81 as STE is varied from 0.6 to 0.8. The corresponding ranges of E_c and $E_c/(E_c + FF)$ are 0.2% to 0.9% and 0.0 to 0.01, respectively.

The Federal Three-mode results (Tables 118, 120, and 122) slightly favor the idle modes. This is based upon the relatively small variation in STRR between modes and upon E_c and $E_c/(E_c + FF)$ being the lowest among the idle modes. The fleet value of STRR ranged from about 0.6 to about 0.8, from 1.5% to 3% for E_c, and 0.03 to 0.04 for $E_c/(E_c + FF)$.

3.3.2.3 Oxides of Nitrogen Emission

The results for both ST are shown in Tables 123 through 136, as follows.

ST Cut-point Selection Technique	Short Test Table Number	
	Federal Short Cycle	Federal Three-mode
STRR = 1.0	123	124
$E_c/(E_c + FF)$ = 10%	125	126
20%	127	128
E_c = 5%	129	130
STE = 0.60	131	132
0.70	133	134
0.80	135	136

a) STRR = 1.0: In the case of the Federal Short Cycle ST (Table 123), the STE value ranges from 0.49 to 0.83 in the CID groups with the 260 CID and greater group having the lowest STE value. E_c varied from 1.3% to 2% and $E_c/(E_c + FF)$ ranged from 0.14 to 0.51.

On the basis of STE value (Table 124), the high-speed mode of the Federal Three-mode ST showed the highest level, 0.29 to 0.49 on the CID groups. The average E_c and $E_c/(E_c + FF)$ were about 2% and 0.65, respectively. The 260 CID and greater group had the lowest value of STE, 0.29 on the high-speed mode.

b) $E_c/(E_c + FF) = 0.1$ and 0.2: Practical solutions were found for all displacement groups only in the case of the Federal Short Cycle ST (Table 127) when the parameter was set at 0.2. For this case, STE was 0.28 on the pooled fleet and ranged from 0.13 on the 260 CID and greater group to 0.85 on the 151 through 259 CID group (see Tables 125 to 128).

c) $E_c = 5\%$: The STE value for the Federal Short Cycle ST (Table 129) ranges from 0.69 to 0.97 on the CID groups,with 1.62 to 1.93 the corresponding STRR range. $E_c/(E_c + FF)$ was in the neighborhood of about 0.50.

In the case of the Federal Three-mode ST (Table 130), the high-speed mode was superior on the basis of STE value which ranged from 0.39 on the 260 CID and greater groups to 0.62 on the 150 CID and less group. The STRR value ranges from 0.93 to 1.63 for the high-speed mode.

d) STE = 0.6, 0.7, and 0.8: For the Federal Short Cycle (Tables 131, 133, and 135), the fleet STRR value ranges from 1.06 to 1.98 as STE varies from 0.6 to 0.8. The corresponding ranges of E_c and $E_c/(E_c + FF)$ are 2.6% to 6.7% and 0.43 to 0.60, respectively.

The Federal Three-mode ST results (Tables 132, 134, and 136) show the high-speed mode as superior in that the lowest level of E_c was obtained for a fixed STE setting. The STRR values were all greater than 1.0 and generally smallest for the high-speed mode.

3.3.2.4 Multiple Constituent Tests

The results for both ST are given in Tables 137 through 150, as follows.

ST Cut-point Selection Technique	Short Test Table Number	
	Federal Short Cycle	Federal Three-mode
STRR = 1.0	137	138
$E_c/(E_c + FF)$ = 10%	139	140
20%	141	142
E_c = 5%	143	144
STE = 0.60	145	146
0.70	147	148
0.80	149	150

In the case of the Federal Three-mode, the "best" mode combination, which was selected on the basis of the correlation coefficient, was the low-speed mode for all three pollutants.

a) STRR = 1.0: In the case of the Federal Short Cycle ST (Table 137), the STE values ranged from 0.90 to 1.00 for the CID groups. The collective STRR value ranges from 0.90 to 1.07 for the CID groups. Typical E_c and $E_c/(E_c + FF)$ values were 4% and 0.03, respectively.

For the Federal Three-mode ST (Table 138), the value of STE routinely exceeded 0.90. Typical range of the STRR value was 0.93 to 0.97 on the pooled fleet. The "best" mode achieved the lowest amount of E_c and lowest level of $E_c/(E_c + FF)$ while maintaining a high STE (0.87 to 0.98) and restricting STRR to below 1.0 (0.93 to 0.97).

b) $E_c/(E_c + FF) = 0.1$ and 0.2: Practical multiple-constituent tests were not identified for either ST (see Tables 139 to 142).

c) $E_c = 5\%$: The STE value for the Federal Short Cycle ST (Table 143) ranges from 0.90 to 1.0 on the CID groups, with 0.90 to 1.07 the corresponding STRR range. The pooled fleet E_c was 6%, with $E_c/(E_c + FF)$ at 0.06.

For the Federal Three-mode ST (Table 144), the "best" mode was preferable with regard to low E_c and $E_c/(E_c + FF)$, where they ranged from 0% to 5.5% and 0.0 to 0.08, respectively, while STE and STRR both ranged from 0.71 to 0.84. The idle modes showed superiority with regard to higher STE and STRR, where they respectively varied from 0.72 to 1.00 and 0.80 to 1.04, while E_c varied from 3% to 7.6%.

d) STE = 0.6, 0.7, and 0.8: For the Federal Short Cycle ST (Tables 145, 147, and 149), the fleet STE value ranged from 0.77 to 0.90 as the STE parameter was varied from 0.6 to 0.8. The corresponding range for STRR was 0.77 to 0.92, for E_c was 0% to 1.7%, and was 0.0 to 0.02 for $E_c/(E_c + FF)$.

In the case of the Federal Three-mode ST (Tables 146, 148, and 150), STE values ranged from 0.84 to 0.92 on the "best" mode for the pooled fleet as the STE parameter was varied from 0.6 to 0.8. The corresponding STRR and E_c ranges were 0.87 to 0.94 and 0% to 2.5%. On the idle modes, STE was 0.83 to 0.95, STRR was 0.88 to 1.04, and E_c was 4.3% to 7.7%.

3.3.2.5 Discussion of 117-Car Fleet Results

For a general discussion of the interrelationships of STE, STRR, E_c, and ST cut-points, see Section 3.3.1.5.

Tables 151 and 152 summarize the ST cut-point by selection technique for the Federal Short Cycle and the Federal Three-mode, respectively. The corresponding policy ranks (refer to Section 3.3.1.5) are given in Tables 153 and 154.

The differences between the mean FTP levels of ST passing vehicles and ST failing vehicles averaged about 1.6 grams/mile HC, 38 grams/mile CO, and 2.0 grams/mile NO_x in the case of the Federal Short Cycle, and were 1.2 grams/mile HC, 28.0 grams/mile CO, and 1.4 grams/mile NO_x in the case of the Federal Three-mode.

3.3.2.6 Parametric Variations

Figures 3-15 through 3-18 and Figures 3-19 through 3-22 illustrate the variation of the cut-point parameters for the Federal Three-mode and the Federal Short Cycle, respectively. See Section 3.3.1.6 for a general discussion of trends.

3.4 207(b) IMPLEMENTATION SIMULATION ANALYSES

The simulation computer programs described in Section 6 of Volume I were used to estimate the differences in air quality benefit resulting from 207(b) implementation under various ST cut-point selection techniques. The results of the analyses are reported below, first for the 300-car fleet and then the 117-car fleet.

3.4.1 Simulations Based Upon 300-Car Fleet

The program components, specific assumptions, and initializing data are described in Section 6.2 of Volume I. Two ST were analyzed, the Federal Short Cycle and the Federal Three-mode, using HC and CO at the idle-in-drive mode and NO_x at the high-speed mode. The emission deterioration rates and annual mileage accumulation schedule are shown in Tables 135 and 136 of Volume I. The initial computer-generated fleet consisted of 3000 vehicles stratified into three engine displacement families, as previously defined. The initial fleet statistics are shown in Table 155.

A 207(b) program was simulated by assuming various ST as determined by cut-point selection techniques. The technique $E_c/(E_c + FF) = 0.1$ or 0.2 did not always yield practical cut-points and therefore was eliminated from the simulation analyses for both ST. The primary

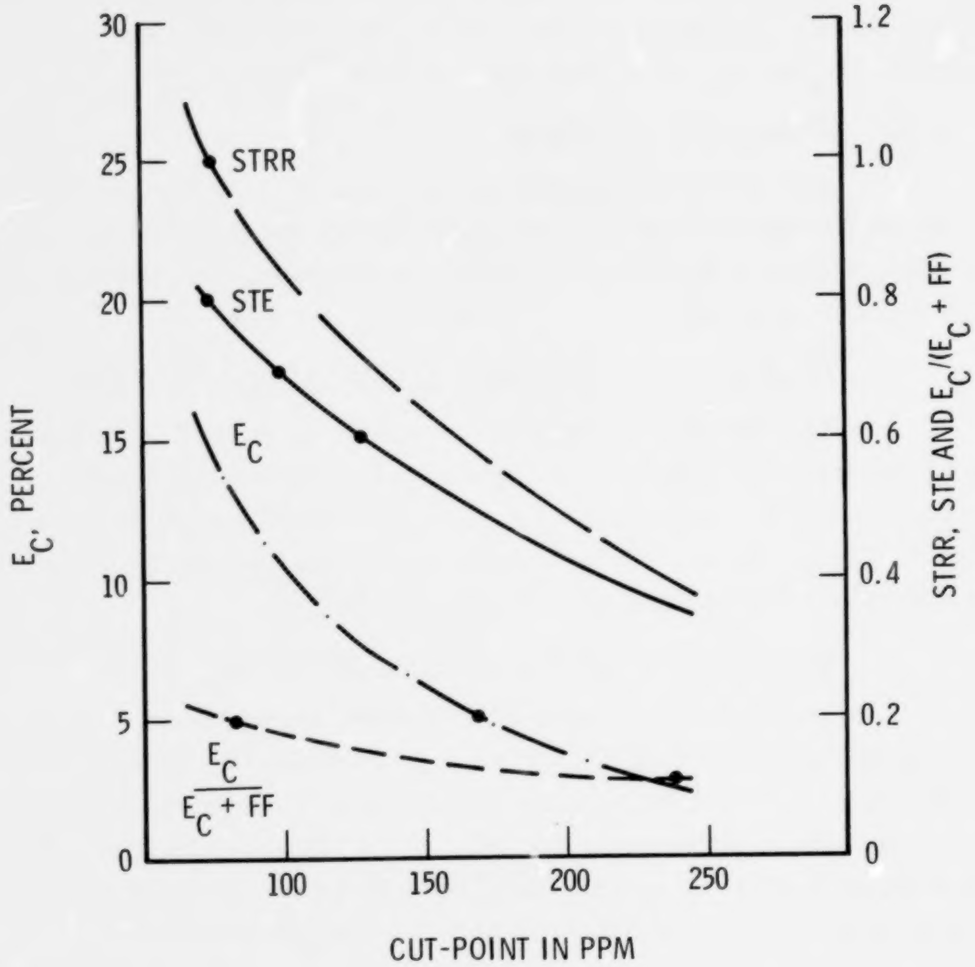


Figure 3-15. Variation of Selected Parameters With HC Cut-Point; Denver Fleet; Federal Three-Mode ST; Idle in Drive Mode

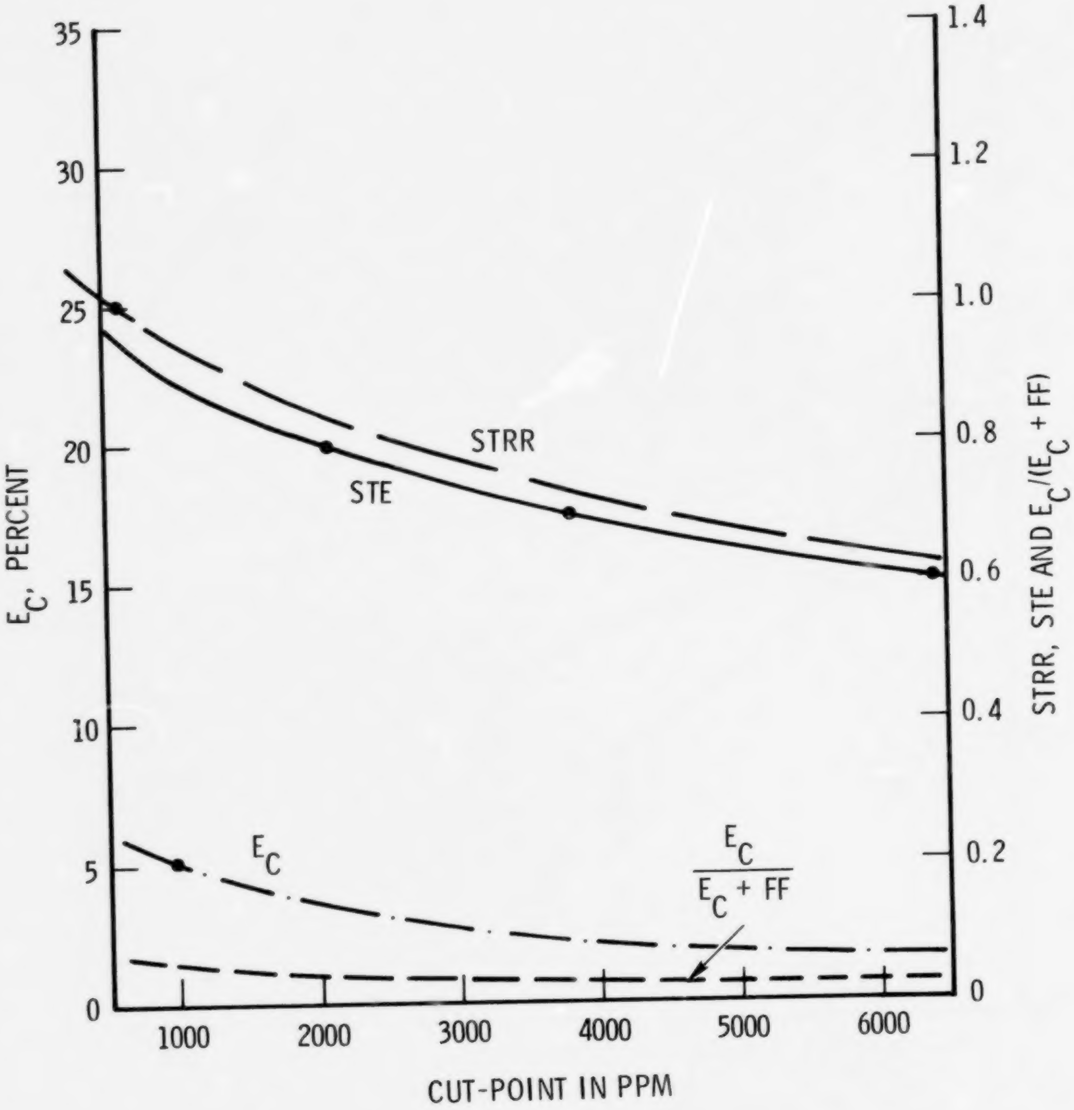


Figure 3-16. Variation of Selected Parameters With CO Cut-Point; Denver Fleet; Federal Three-Mode ST; Idle in Drive Mode

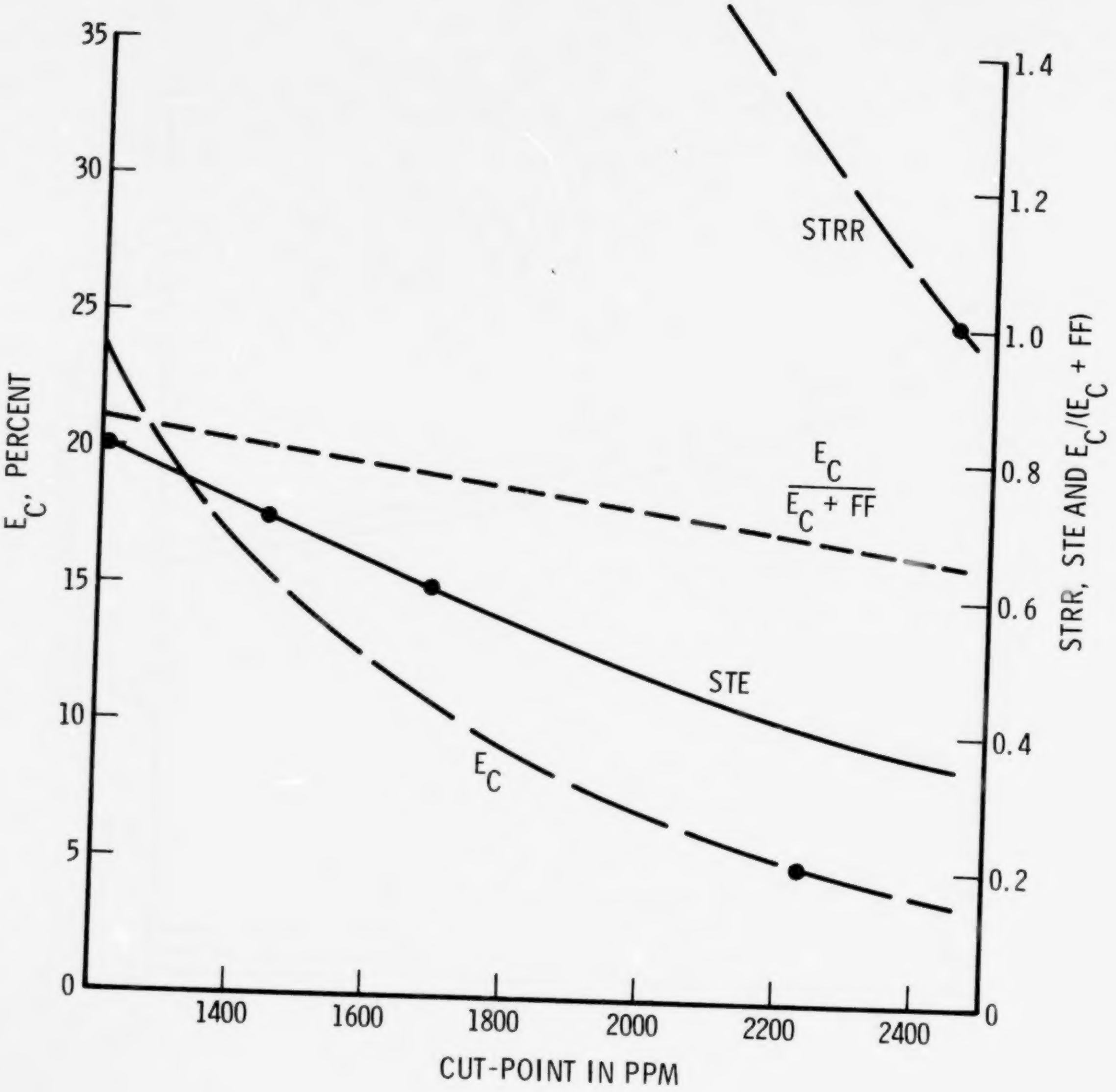


Figure 3-17. Variation of Selected Parameters With NO_x Cut-Point; Denver Fleet; Federal Three-Mode ST; High-Speed Mode

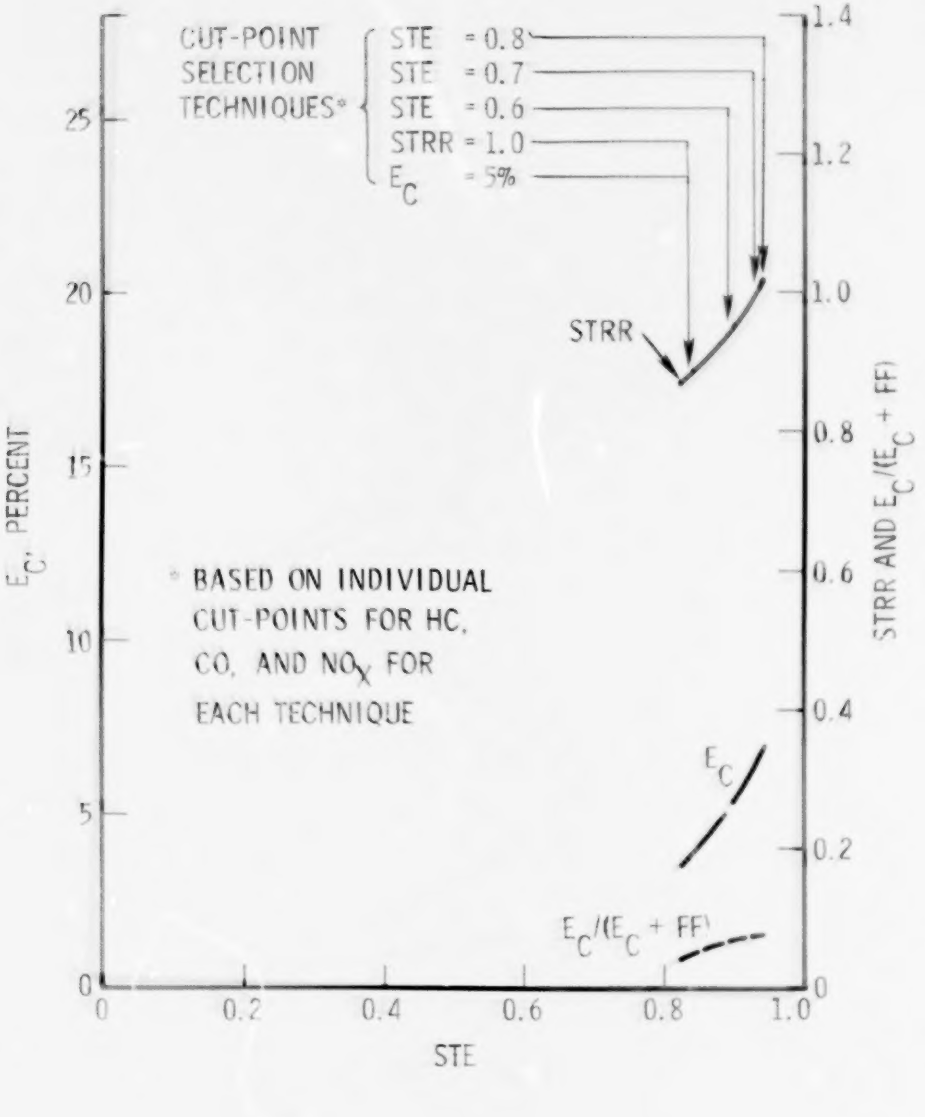


Figure 3-18. Variation of Selected Parameters With STE on Multiple Constituents Test; Denver Fleet; Federal Three-Mode ST; Idle in Drive Mode

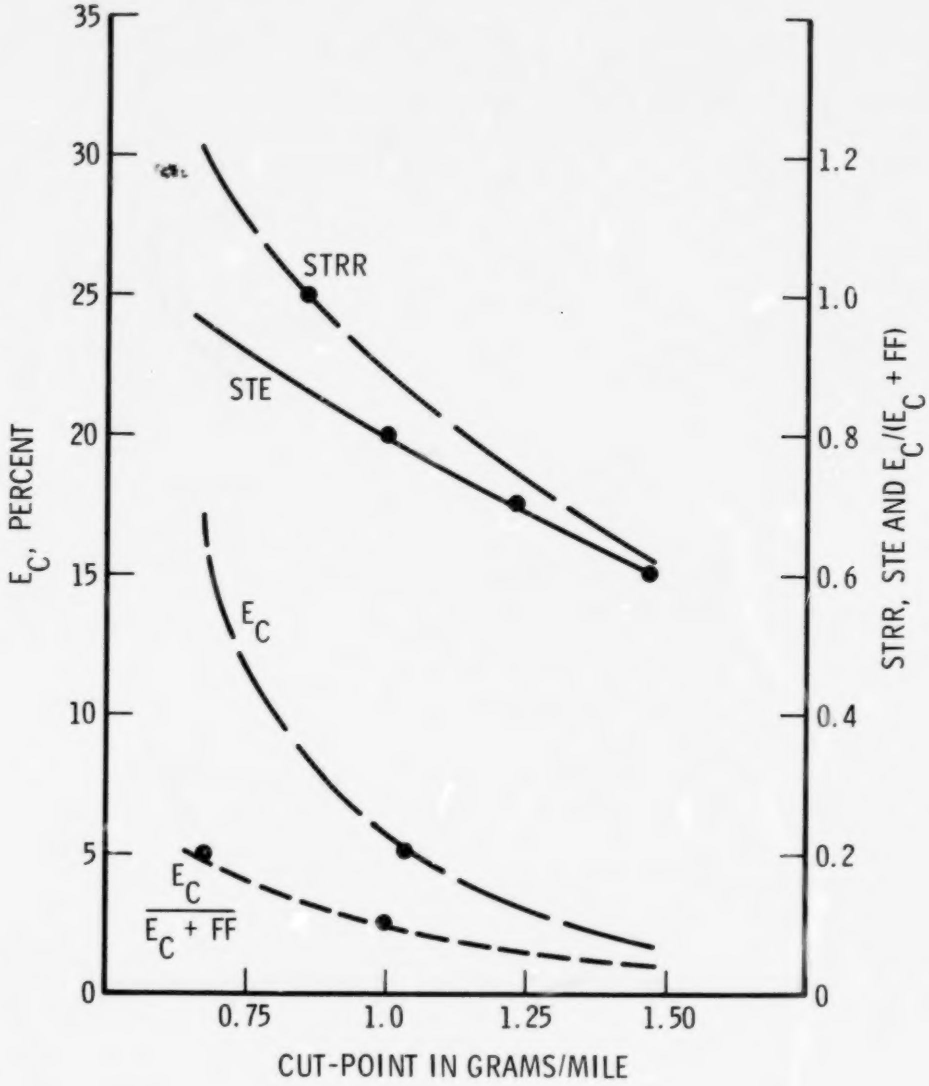


Figure 3-19. Variation of Selected Parameters With HC Cut-Point; Denver Fleet; Federal Short Cycle ST

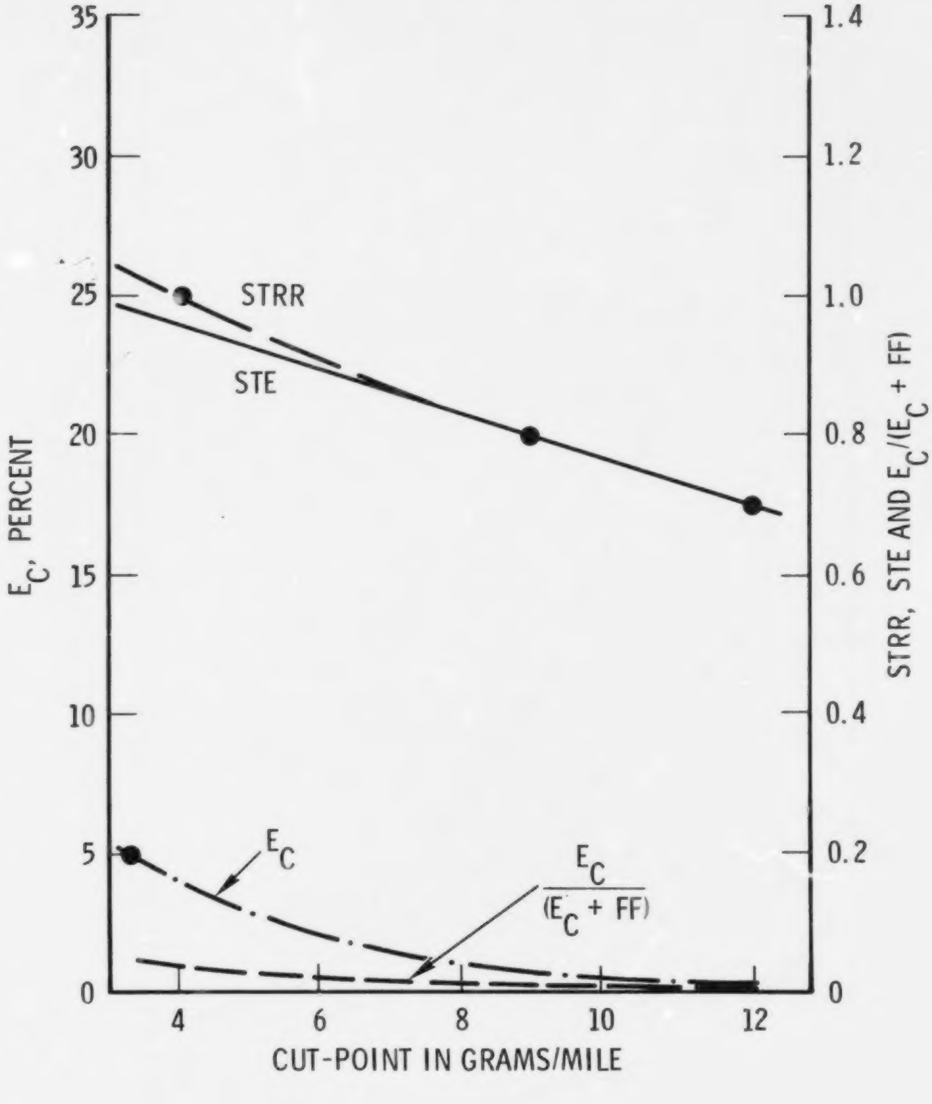


Figure 3-20. Variation of Selected Parameters With CO Cut-Point; Denver Fleet; Federal Short Cycle ST

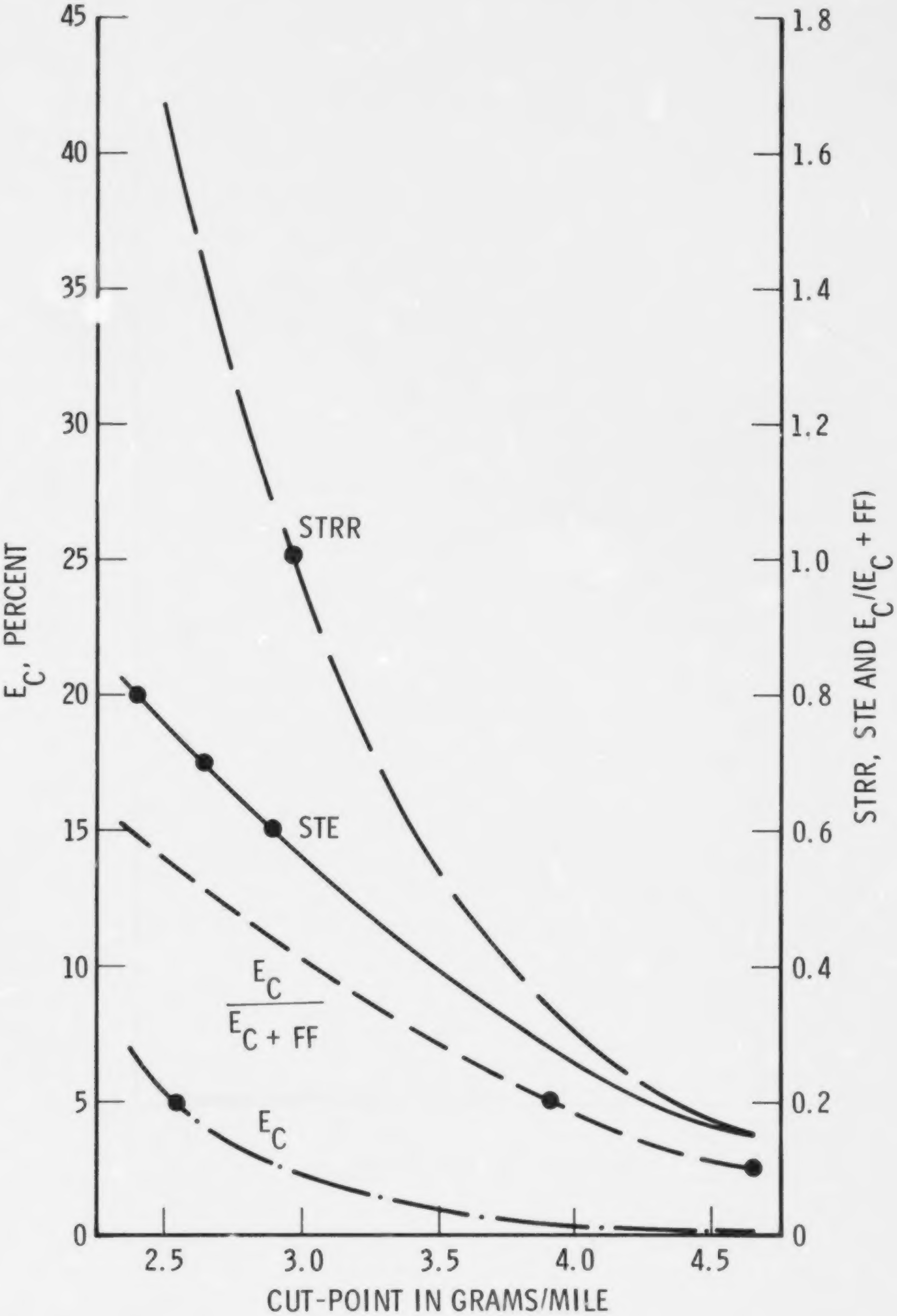


Figure 3-21. Variation of Selected Parameters With NO_x Cut-Point; Denver Fleet; Federal Short Cycle ST

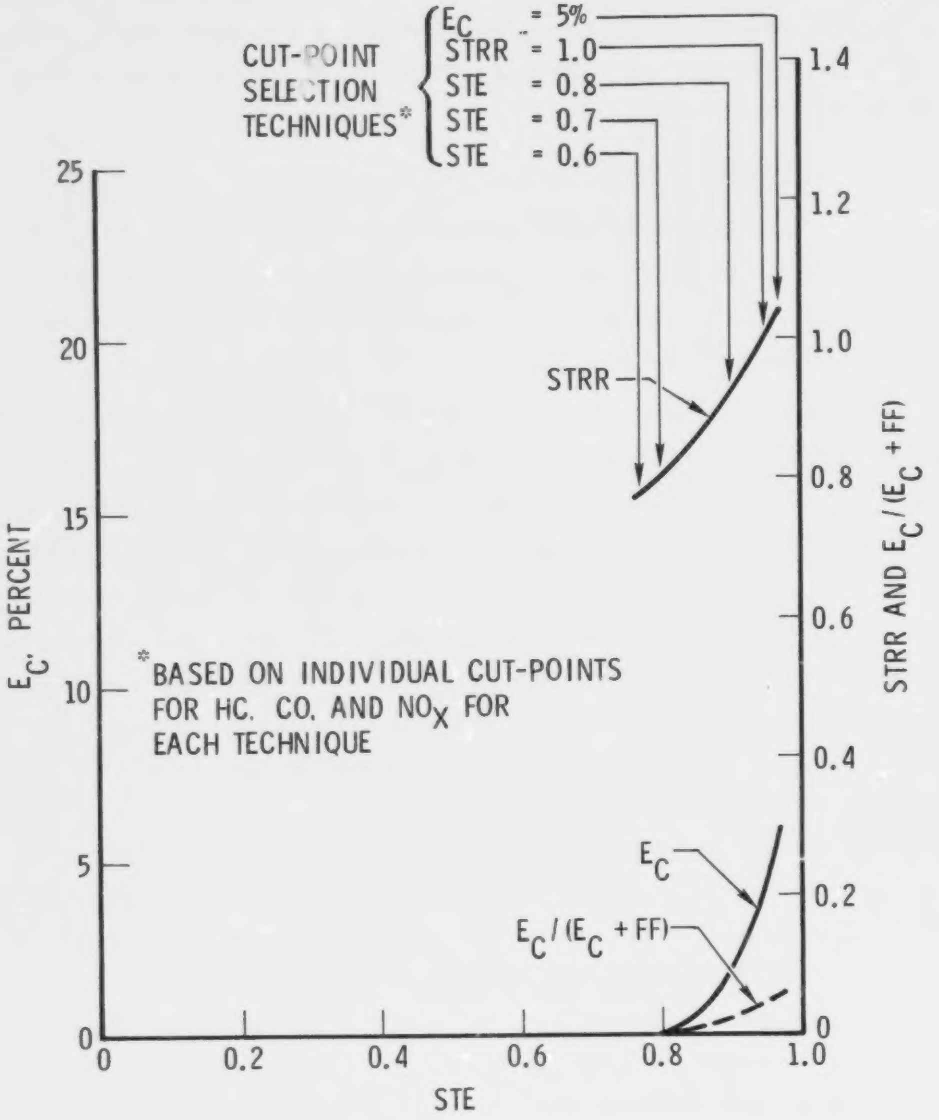


Figure 3-22. Variation of Selected Parameters With STE on Multiple Constituents Test; Denver Fleet; Federal Short Cycle

techniques studied for both ST were STRR = 1.0, E_c = 5%, and STE = 0.60. The techniques STE = 0.7 and STE = 0.8 were generally discarded on the basis of STRR exceeding 1.0 for one or more engine families on at least one of the ST. The effects of varying STE are investigated on a limited basis in Section 3.4.1.3.

3.4.1.1 Effects of Cut-point Selection Technique

For each technique studied and each ST simulated, all maintenance model versions (1, 2, and 3) were simulated with periods of effectiveness of 12, 9, and 6 months on each version, as previously discussed in Section 6.2.4 of Volume I.

a) STRR = 1.0: The ST cut-points are shown in Tables 156 and 158 for the Federal Short Cycle and the Federal Three-mode, respectively. The associated FTP values equivalent to the 207(b) cut-points (see Section 3.2) are given in Tables 157 and 159. If the FTP equivalent of the respective ST cut-point fell below the corresponding FTP standard, the FTP standard was taken as the FTP emission level after maintenance. Hence, for this set of cut-points, Tables 157 and 159 merely contain the FTP standards. The simulation results are shown in Tables 160 and 161, respectively, for the Federal Short Cycle and the Federal Three-mode. Two efficiencies have been reported. The efficiency "over program life" is based upon the accumulated emissions since the first inspection, and does not include the first year of operation. The efficiency "over fleet life" is based upon the accumulated emissions over the entire 50,000 miles, and does include the first year of operation. Since the inspection and maintenance program (as simulated) does not affect emissions in the first year of operation, the efficiencies over fleet life are less than those over program life by about 25% in the case of STRR = 1.0.

The estimated HC and CO efficiencies are slightly higher if the Federal Short Cycle as opposed to the Federal Three-mode is used to test vehicles. The difference is about 1% on the average for HC and CO. NO_x efficiencies are small and variable in nature. This is due to the stochastic behavior of the inspection model and the fact that NO_x deterioration has been taken to be zero. The efficiencies are equal for maintenance version 2 and version 3 for both the Federal Short Cycle and the Federal Three-mode, since the FTP equivalent cut-points were held at the FTP standard on version 3. The Federal Three-mode "over program life" efficiency at 50,000 miles is 40% for HC and ranges from 44% to 50% for CO, using a 12-month period of effectiveness. The corresponding efficiency at the end of the first year of the program is 27% for HC and ranges from 34% to 40% for CO. Maintenance version 1 generally had the higher CO efficiency, while versions 2 and 3 were lower.

The fact that the CO efficiency is reduced on maintenance versions 2 and 3 illustrates that CO alone is not enough to completely characterize the HC and CO state of a vehicle, although they are highly correlated. The fact that efficiencies decrease with decreasing periods of effectiveness supports the intuitive relation that longer-lasting repairs result in larger emission reductions.

b) $E_c = 5\%$: The ST cut-points are shown in Tables 162 and 164 for the Federal Short Cycle and the Federal Three-mode, respectively, with the associated FTP equivalent cut-points shown in Tables 163 and 165. The simulation results are given in Table 166 for the Federal Short Cycle and Table 167 for the Federal Three-mode.

The Federal Short Cycle shows slight superiority over the Federal Three-mode when comparing HC and CO efficiencies. The average difference in efficiency is 2% to 3% on both HC and CO. The "over fleet life" efficiencies are about 25% lower than the "over program life" efficiencies. The first year of program efficiencies for the Federal Three-mode ranges from 21% to 23% for HC and 28% to 34% for CO using a 12-month period of effective maintenance. The corresponding 50,000-mile efficiencies range from 33% to 35% for HC and from 38% to 44% for CO. NO_x efficiency was usually less than 1%.

c) STE = 0.6: The ST cut-points and their FTP equivalent values are shown in Tables 168 and 169 for the Federal Short Cycle and Tables 170 and 171 for the Federal Three-mode. The simulation results are given in Tables 172 and 173 for the Federal Short Cycle and Federal Three-mode, respectively.

The Federal Three-mode is slightly superior in predicted efficiency than the Federal Short Cycle. One explanation for this reversal in ST superiority is the relative difference of the FTP equivalent cut-points for the two ST. Comparing Tables 169 and 171 shows that the Federal Three-mode ST cut-points in equivalent FTP units are uniformly less than or equal to the Federal Short Cycle cut-points. Hence the Federal Three-mode ST will show an increased benefit for maintenance version 3, since the adjusted values of the maintenance will be lower than for the Federal Short Cycle.

The difference in HC and CO efficiencies between the two short tests is about 1% for both pollutants. The Federal Three-mode first-year efficiencies "over program life" using a 12-month period of effectiveness varied from 30% to 37% on CO and was 25% for HC. The corresponding 50,000-mile efficiencies were 38% HC and 41% to 48% for CO. NO_x efficiency was generally less than 1%.

3.4.1.2 Effect of Varying STE

A series of simulations was performed for maintenance version 3 at a 12-month period of effectiveness to investigate the program efficiencies at higher levels of STE. Both the Federal Short Cycle and Federal Three-mode short tests were used, taking cut-points as determined by the selection techniques STE = 0.6, 0.7, and 0.8 for each pollutant. The various ST cut-points and their respective FTP equivalent values are shown in Tables 168 through 181. The simulation results are summarized in Table 182.

The difference in efficiency for HC and CO between the two ST is less than 1%. Clearly, as the STE is increased, so are the program efficiencies. As STE changes from 0.6 to 0.8, the Federal Three-mode first-year efficiency varies from 25% to 29% HC, 30% to 35% CO over the program life. The corresponding 50,000-mile efficiencies range from 38% to 42% HC, and 40% to 46% CO over the program life.

3.4.1.3 I/M Program vs. 207(b) Program

To investigate the differences between I/M programs (simulated to reflect the use of cut-points based upon the pooled fleet) and 207(b) programs (cut-points based upon engine families within the fleet), a series of computer runs was performed using maintenance version 3 with a 12-month period of maintenance effectiveness. The I/M ST cut-points are shown in Tables 183 and 185 for the Federal Short Cycle and the Federal Three-mode, respectively. The corresponding FTP equivalent values are shown in Tables 184 and 186. The simulation results are shown in Table 187.

The general trends observed for the 207(b) simulations were present for I/M programs. That is, the Federal Short Cycle results in greater air quality benefit for the techniques STRR = 1.0 and E_c = 5%, while the Federal Three-mode results in greater air quality benefit for the technique STE = 0.6.

For STRR = 1.0, the difference in HC and CO efficiencies between I/M and 207(b) programs is negligible for both ST. For E_c = 5%, the maximum difference is about 1% (for CO) on both ST. For STE = 0.6, the difference for HC and CO is less than 1% for both ST.

3.4.2 Simulations Based Upon 117-Car Fleet

Simulations of a 207(b) program were performed, based upon the data collected from the 117 cars in Denver. Both the Federal Short Cycle and the Federal Three-mode using HC and CO idle-in-drive and NO_x at the high speed were simulated. The emission deterioration rate and annual mileage accumulation assumptions are shown in Tables 135 and 136 of Volume I. The computer-generated fleet consisted of 3000 vehicles stratified into three engine displacement families, as previously defined. The initial fleet statistics are given in Table 189.

The ST cut-point techniques studied were STRR = 1.0, E_c = 5%, and STE = 0.6. For each technique and each ST, all three maintenance models were used with periods of effectiveness of 12, 9, and 6 months, as described in Section 6.2.4 of Volume I.

a) STRR = 1.0: The ST cut-points are shown in Tables 190 and 192 for the Federal Short Cycle and the Federal Three-mode, respectively. The associated FTP values equivalent to the 207(b) cut-points are given in Tables 191 and 193. The simulation results are given in Tables 194 and 195.

The Federal Short Cycle is slightly superior to the Federal Three-mode by about 1% over the fleet life and about 3% over the program life for HC and CO. Maintenance version 3 yielded more conservative efficiencies, while version 1 yielded the highest values. The "over fleet life" efficiencies were about 40% less than the "over program life" efficiencies. The Federal Three-mode first-year efficiencies over the program life range from 32% to 36% for HC and 33% to 47% for CO for a 12-month period of effectiveness. The corresponding 50,000-mile efficiencies range from 42% to 46% for HC and 40% to 55% for CO. The effect of reducing the period of maintenance effectiveness to six months was to reduce the efficiencies by approximately 50%.

b) E_c = 5%: The ST cut-points and their equivalent values in FTP units are shown in Tables 196 and 197 for the Federal Short Cycle and Tables 198 and 199 for the Federal Three-mode. The simulation results are shown in Tables 200 and 201.

The Federal Short Cycle is slightly superior to the Federal Three-mode for HC and CO by about 4% over fleet life and about

6% to 8% over program life. The "over fleet life" efficiencies were about 30% less than the "over program life" efficiencies. The Federal Three-mode first-year efficiencies over the program life range from 25% to 30% for HC and 25% to 41% for CO, using a 12-month period of maintenance effectiveness. The corresponding 50,000-mile efficiencies range from 36% to 41% for HC and 33% to 48% for CO.

c) STE = 0.6: The ST cut-points and their equivalent FTP values are given in Tables 202 and 203 for the Federal Short Cycle and Tables 204 and 205 for the Federal Three-mode. The simulation results are shown in Tables 206 and 207.

The Federal Short Cycle is slightly superior to the Federal Three-mode for HC and CO by approximately 2% over fleet life and 2% to 4% over program life. The "over fleet life" efficiencies were about 40% less than the "over program life" efficiencies. The Federal Three-mode first-year efficiencies over the program life range from 25% to 31% for HC and 26% to 42% for CO, using a 12-month period of maintenance effectiveness. The corresponding 50,000-mile efficiencies range from 35% to 41% for HC and 33% to 50% for CO.

3.4.3 Discussion of Simulation Results

The first-year efficiencies for both fleets are summarized in Table 208 for maintenance version 3. The techniques having the higher efficiencies on HC and CO usually had the higher ranks (Tables 94 and 154). Efficiencies were usually higher for the 117-car fleet than for the 300-car fleet. For STRR = 1.0 and E_c = 5%, the higher HC efficiencies for the 117-car fleet are possibly explained by the higher level of HC STE on the 117-car fleet. As noted in Section 3.3, the high STE in the 117-car fleet is primarily an altitude effect in that nearly 90% of the high-altitude vehicles fail the FTP, whereas 60% of the low-altitude vehicles fail the FTP. For STE = 0.7, the error of omission rate for the 117 cars is approximately twice that of the 300-car fleet for each engine family stratum.

The maximum difference between the efficiencies with varying periods of maintenance effectiveness is about 10% for HC and 14% for CO on the 300-car fleet and 12% for HC and 14% for CO on the 117-car fleet.

If the techniques are ranked by their efficiency in ascending order, then the ranks would show the same ordering of the techniques, as given in Tables 94 and 154 for each of the fleets.

4. SHORT TEST CORRELATION ANALYSES ON 1974 MODEL YEAR AND 1975-PROTOTYPE VEHICLES

This section contains the results of an extended contingency table analysis using data collected on 1974 model year and 1975-prototype vehicles under the FTP/ST correlation analysis program (Reference 2). These analyses were performed to assess the sensitivity of the correlations to FTP measurement variability and to assess the variability of the FTP.

4.1 FLEET COMPOSITION

The vehicles analyzed under the FTP/ST Correlation Analysis Program consisted of two separate fleets. The characteristics of these fleets, described in detail in Reference 2, are briefy summarized as follows:

a) Catalyst-Equipped Experimental Vehicle Fleet (CEV Fleet): This fleet consisted of 40 "1975-prototype" Ford Galaxies, owned by the Ford Motor Company. Two replicate FTP tests were performed on 26 of these vehicles.

b) In-Use 1974 Model Year Vehicle Fleet: This fleet consisted of 147 1974 model year vehicles. Included in this fleet were 49 Ford Pintos, 49 Chevrolets (Caprice and Impala), and 49 Dodge/Plymouths (Coronet, Charger, Satellite). Federal Short Cycle, Federal Three-Mode, and FTP tests were performed on 144 of these vehicles.

4.2 ANALYSIS OF FTP REPLICATE TESTS PERFORMED ON THE CATALYST-EQUIPPED EXPERIMENTAL VEHICLES (CEV)

Using the FTP replicate test data from the 26 cars of the CEV fleet, a contingency table analysis was performed in which the first FTP level for a given vehicle was taken as its true FTP level, and the second FTP level was used as its "short test" level. Cut-points for HC, CO, and NO_x were selected for the "ST levels" using the two techniques E_c=5% and STRR=1.0. As the appropriate FTP standards to which the CEV fleet was designed were uncertain, four sets of FTP standards were used in the analysis, as specified in Table 209.

As noted in Section 3.1.1, the technique STRR = 1.0 is equivalent to adjusting the ST failure rate to equal that of the FTP failure rate. Since the ST and the FTP under analysis here are replicate measurements from the 1975 FTP, the results of applying this technique may be used to characterize the quality of the 1975 FTP.

The other relevant information produced by these analyses is the relative uncertainty inherent in the FTP standards used against the data. Although the FTP standards are precise fixed points in each analysis, the number of vehicles passing and failing the FTP will vary from data set to data set and can be quantified in terms of FTP standard uncertainty which is produced by the measurement process.

The results, presented below, are presented first on the basis of individual pollutant, followed by the results of a multiple-constituent test.

4.2.1 Hydrocarbon Emission

The results are given in Tables 210 and 211 for the techniques STRR = 1.0 and E_c = 5%, respectively.

a) STRR = 1.0, Table 210: The STE value decreased from 0.92 to 0.78 as the HC standard increased from 0.41 gram/mile to 0.90 gram/mile. The total error rate ($E_c + E_o$) varied between 9.8% and 13.2% in response to varying the HC standard. The ST cut-points, in both ST and FTP units, shown in Table 210, tend to closely track the HC standard.

b) E_c = 5%, Table 211: The STRR value varied from 0.93 to 1.01 as the HC standard was changed. The STE values decrease from 0.90 to 0.78 as the HC standard was increased. The ST cut-points shown in Table 211 indicate the same trend as was reported for the previous technique.

The closeness and similarity of the results of the two techniques are a direct consequence of the fact that for STRR = 1.0, E_c is approximately 5% and vice versa at each HC standard.

4.2.2 Carbon Monoxide Emission

The results are summarized in Tables 212 and 213 for the respective techniques STRR = 1.0 and E_c = 5%.

a) STRR = 1.0, Table 212: The STE value decreased from 0.77 to 0.51 as the CO standard was increased from 3.4 grams/mile to 9.0 grams/mile. The total error rate likewise decreased from 10.8% to 0.4% in response to the increases in the CO standard. The ability of the ST cut-point to track the standard deteriorated as the standard increased. The decreasing error rate and inability to track the CO standards when coupled with the extreme decrease in the FF rate (18% to 0.2%) indicate that the analysis is being performed in a tail region of the distribution; i.e., where the probability of vehicles having high emission values, such as exceeding the standard, is extremely low. Thus, characterization of the FTP measurement process should be drawn at the lower values of the CO standard.

b) E_c = 5%, Table 213: The STRR value increased from 0.92 to 13.67 as the CO standard was increased. The corresponding STE values varied from 0.76 to 0.99.

As the CO standard is increased, the FTP rate tends rapidly to zero. Hence the E_c = 5% technique is disproportionately unfair in terms of STRR, even though the total error rate is 5% (i.e., $E_o \simeq 0\%$) at the CO standard of 9.0 grams/mile. At the CO standard of 3.4 grams/mile, the two techniques yield equivalent results: total error rate of 10.8%, STE $\simeq$ 0.77, and an ST cut-point close to the CO standard.

4.2.3 Oxides of Nitrogen Emission

Tables 214 and 215 summarize the results of the techniques STRR = 1.0 and E_c = 5%.

a) STRR = 1.0, Table 214: The STE value is 0.58, and the total error rate is 16.8% (E_c = 8.4%) as compared with the FF rate of 11.4%.

The ST cut-point (2.99 grams/mile) closely approximates the NO_x standard of 3.1 grams/mile.

b) $E_c = 5\%$, Table 215: Since $E_c = 5\%$ is below the E_c rate produced by the previous technique, STRR (0.71) and STE (0.47) are likewise reduced. The ST cut-point (3.14 grams/mile) is increased over the cut-point determined by the previous technique.

Two observations noticeably distinguish the NO_x results: the relatively high error rate in proportion to the vehicles correctly identified, and the sensitivity of the parameters to shifts in the ST cut-point. For example, the cut-points as determined by the techniques differ by 0.15 gram/mile about a level of 3.1 grams/mile. This difference was reflected in a 30% difference in STRR and a 17% difference in STE.

4.2.4 Multiple Constituent Tests

The multiple-constituent test results are summarized in Tables 216 and 217 for both techniques.

a) STRR = 1.0, Table 216: The resulting STRR value varied from 0.86 to 1.18 for the various FTP levels. The corresponding variation in STE was 0.71 to 1.0 and was 19% to 0% for the total error rate.

b) $E_c = 5\%$, Table 217: The results closely follow those of the previous technique.

As was discussed in Reference 2, the dominant pollutant in the multiple-constituent results for this fleet was HC. Similarity of the HC results and the multiple-constituent results is therefore present in this analysis.

4.3 ANALYSIS OF IN-USE 1974 MODEL YEAR VEHICLES BY INERTIA WEIGHT CLASS

Using the FTP/ST data on the 147-car fleet of in-use 1974 model year vehicles (Reference 2), a contingency table analysis by inertia weight was performed. The fleet was stratified into three inertia weight groups as follows.

a) 2501 to 3500 lb class:
Consisted of 46 Ford Pintos, each having an inertia weight of 2750 lb (140 CID)

b) 3501 to 4501 lb class:
Consisted of 49 Dodge/Plymouths, each having an inertia weight of 4000 lb (318 CID)

c) From 4501 lb class:
Consisted of 49 Chevrolets, each having an inertia weight of 5500 lb (400 CID)

Federal Three-mode and Federal Short Cycle cut-points were determined for HC, CO, and NO_x for each inertia weight group, using the two techniques $E_c = 5\%$ and STRR = 1.0. The FTP measurements were made using the 1975 FTP, and the FTP standards used for this analysis (in 1975 FTP units) were 3.02 grams/mile HC, 28.0 grams/mile CO, and 3.10 grams/mile NO_x.

The results are presented below, first by individual pollutant, followed by the multiple-constituent test results.

4.3.1 Hydrocarbon Emission

The results are summarized in Tables 218 through 221 for both ST as follows.

ST Cut-point Selection Technique	Short Test Table Number	
	Federal Short Cycle	Federal Three-mode
STRR = 1.0	218	219
$E_c = 5\%$	220	221

a) STRR = 1.0: In the case of the Federal Short Cycle, Table 218, the STE value ranges from 0.18 to 0.93 for the inertia weight groups, and is 0.79 for the pooled fleet. The influence of the FTP failure rate in determining the contingency table parameters is quite visible. The heaviest vehicles had an FTP failure rate of 1.12%, with an associated FF of 0.2% (STE = 0.18), whereas the medium-weight cars had an FF value of 75.6% and an associated E_o rate of 5.7% (STE = 0.93). The pooled fleet E_c was 6.4%, with an $E_c/(E_c + FF)$ of 0.21.

For the Federal Three-mode ST, Table 219, the idle mode was superior on the basis of STE value for the pooled fleet and the weight groups, with the exception of the heaviest vehicle group. The idle mode STE value ranged from 0.01 to 0.86 on the inertia weight groups, with the 5500-lb vehicles scoring the lowest, and was 0.57 on the pooled fleet. The E_c rate was 14.2% for the pooled fleet.

The extreme variance in the results from each inertia weight group is probably technologically based. The small and heavy vehicle groups have idle mode cut-points close in value, 133 ppm and 124 ppm, respectively, whereas the intermediates had a cut-point of 24 ppm. As noted above, the FTP failure rates were extremely divergent.

b) E_c = 5%: In the case of the Federal Short Cycle ST, Table 220, the STE value ranged from 0.46 to 0.92 on the inertia weight groups, and was 0.75 for the pooled fleet. The corresponding STRR value varied from 0.98 to 4.94 on the weight groups, and was 0.91 over all vehicles.

For the Federal Three-mode ST, Table 221, the idle mode is generally superior with the exception noted above. The STE value for this mode was 0.32 on the pooled fleet, with an associated STRR of 0.47, and varied from 0.02 to 0.62 on the weight groups, with a corresponding STRR range of 0.68 to 2.79. The idle mode cut-points vary from 49 ppm to 163 ppm on the weight groups.

4.3.2 Carbon Monoxide Emission

The results are given in Tables 222 through 225 for both ST as follows.

ST Cut-point Selection Technique	Short Test Table Number	
	Federal Short Cycle	Federal Three-mode
STRR = 1.0	222	223
E_c = 5%	224	225

a) STRR = 1.0: For the Federal Short Cycle ST, Table 222, the STE value varied from 0.71 to 0.98 on the inertia weight groups and was 0.90 for the pooled fleet. The accompanying E_c values were 2.2% to 15.2% on the weight groups, and 7.5% for the combined fleet. The FTP failure rate varied from a low of 43.2% on the heavy vehicles to a high of 91.2% on the intermediates.

The Federal Three-mode ST, Table 223, showed the idle mode to be uniformly superior on the basis of STE value, which was 0.65 to 0.95 on the inertia groups, and 0.86 for the pooled fleet. The idle mode E_c rate was 10.4% on the combined fleet and ranged from 4.9% to 18.9% on the weight groups. The idle mode ST cut-point varied between 0.17% and 0.24% for the inertia weight groups and was 0.20% for the pooled fleet.

b) E_c = 5%: In the case of the Federal Short Cycle ST, Table 224, the inertia weight group STE and STRR values varied from 0.42 to 1.00 and 0.51 to 1.05, respectively, and the pooled fleet values were 0.81 on STE and 0.91 on STRR. The ST cut-points for the weight groups were between 18.0 grams/mile and 34.0 grams/mile.

The idle mode of the Federal Three-mode ST, Table 225, was uniformly superior on the basis of STE, which was 0.27 to 0.95 for the inertia weight groups and 0.69 for the pooled fleet. The corresponding STRR values were 0.36 to 1.00 for the vehicle groups and 0.76 on the combined fleet. The idle mode ST cut-points were between 0.24% and 0.56%.

4.3.3 Oxides of Nitrogen Emission

The NO_x results are summarized in Tables 226 through 229 for both ST, as follows.

ST Cut-point Selection Technique	Short Test Table Number	
	Federal Short Cycle	Federal Three-mode
STRR = 1.0	226	227
$E_c = 5\%$	228	229

a) STRR = 1.0: In the case of the Federal Short Cycle ST, Table 226, the STE value varied from 0.19 to 0.55 on the vehicle weight groups and was 0.50 for the entire fleet. The E_c range for the vehicle groups was 1.8% to 9.2%, and was 8.6% on the whole. The ST cut-points were between 1.75 grams/mile and 3.98 grams/mile.

The mode superiority was mixed for the Federal Three-mode ST, Table 227. The high-speed mode had the highest STE, 0.44, for the pooled fleet, whereas the low-speed mode was uniformly the highest in STE, 0.30 to 0.60, for the inertia weight groups. The low-speed mode cut-point varied from 2035 ppm to 341 ppm, while E_c ranged from 1.6% to 11.4%.

b) $E_c = 5\%$: The Federal Short Cycle STE values, Table 228, varied from 0.41 to 0.55, accompanied by an STRR variation of 0.66 to 2.64 on the inertia weight groups. The ST cut-points were between 1.91 and 3.39 grams/mile.

For the Federal Three-mode ST, Table 229, mode superiority trends are the same as noted in the previous technique. The low-speed mode STE and STRR ranges are 0.41 to 0.54 and 0.58 to 2.83, respectively. The cut-points for the low-speed mode are between 2263 ppm and 371 ppm.

4.3.4 Multiple Constituent Tests

The multiple-constituent results are summarized in Tables 230 through 233 for both ST as follows.

ST Cut-point Selection Technique	Short Test Table Number	
	Federal Short Cycle	Federal Three-mode
STRR = 1.0	230	231
E_c = 5%	232	233

The best combination of modes based upon the pooled fleet correlation coefficients was found to be HC and CO at idle and NO_x at the high-speed mode.

a) STRR = 1.0: For the Federal Short Cycle ST, Table 230, the STRR value ranged from 0.95 to 1.03 on the inertia weight groups, and was 1.00 for the entire fleet. STE, E_c, and FF ranged between 0.68 and 0.96; 4.1% and 22.5%; and 42.9% and 91.8%; respectively. The ST discrimination was poorest on the heavy vehicles.

For the Federal Three-mode ST, Table 231, the STE values for the best mode combination are between 0.65 and 0.96. The corresponding E_c and STRR ranges are 2.0% to 18.4% and 0.94 to 0.98. Although other mode combinations had higher STE values, the E_c level was also generally higher and STRR frequently exceeded 1.0.

b) E_c = 5%: STE varied from 0.45 to 0.96 for the Federal Short Cycle ST, Table 232, on the inertia weight groups. The associated E_c and STRR ranges are 4.1% to 6.1% and 0.55 to 1.00.

For the Federal Three-mode ST, Table 233, the STE values for the best mode combination are between 0.39 and 0.94. The E_c values are between 2.0% and 4.1%, while STRR is between 0.45 and 0.96. In those cases where other mode combinations had higher STE, the E_c was also elevated.

4.4 DISCUSSION OF RESULTS

With regard to the analysis of the FTP replicate data on 26 cars, the STRR = 1.0 technique results can be used to characterize the quality of the FTP. The estimated error rates were 11.4% HC, 10.8% CO, 16.8% NO_x, and 19.2% on the multiple-constituent FTP at the lowest level of FTP standards (0.41, 3.4, and 3.1 grams/mile). At this same set of FTP standards, the "ST" cut-points determined from the second replicate (0.42, 3.35, 2.99 grams/mile) closely agree with the assumed standards.

For the 1974 model year fleet of in-use vehicles, the correspondence between inertia weight group classification and the CID grouping classification used for the 1975 model year vehicles is not one-to-one, since there were no vehicles with engine displacements of 151 to 259 CID. (The Pintos were 140 CID, the Dodge/Plymouths were 318 CID, and the Chevrolets were 400 CID.) Hence, strictly parallel comparisons by group cannot be made.

However, this fleet does point out the difficulties stemming from technological differences probably more effectively than the 300-car analyses, as the inertia weight groups are homogeneous with respect to vehicle nomenclature and equipment. The persistence of the idle mode as an effective ST on HC and CO and of the high- and low-speed modes for NO_x discrimination for both the 1974 and 1975 vehicles is an important finding which reflects a basic invariant in the Federal Three-mode ST.

5. SHORT TEST VARIABILITY

This section discusses the methodology and calculation techniques applied to estimate the standard errors of the ST cut-points and of other contingency table parameters. The results of the calculations also are summarized in this section.

5.1 DISCUSSION OF METHODOLOGY

The applicable methods used for individual pollutant analysis are presented first, followed by the multiple-constituent procedures.

5.1.1 Individual Pollutants

5.1.1.1 ST Cut-point Estimation

For the three ST cut-point selection techniques, STRR = 1.0, $E_c = \gamma\%$, and STE = α, the problem of estimating the cut-point is closely related to the statistical problem of estimating quantiles of a statistical distribution function. A quantile is a value of the random variable (such as HC concentration on vehicles with displacement of 150 CID or less) which divides the area under the probability curve into two parts, each consisting of a specified percentage of the area.

As discussed in Section 3.1, the technique STRR = 1.0 is equivalent to adjusting the ST failure rate (E_c + FF) to equal the FTP failure rate (E_o + FF). Hereafter the FTP failure rate will be denoted as F%. Hence the appropriate ST cut-point is the ST value which divides the vehicle population under analysis into a failing group having F% vehicles and a passing group having 100% - F% vehicles.

The situation is quite similar for the technique $E_c = \gamma\%$. Although E_c is expressed as a percent of the total population, for a fixed FTP standard, E_c can be expressed as a percent of the vehicles passing the FTP. If P% pass the FTP, then E_c equaling $\gamma\%$ of all vehicles is equivalently $(\gamma/P)\%$ of the passing vehicles. The value of the ST which divides the FTP passing vehicles into an ST failing group (the E_c's, consisting of $(\gamma/P)\%$ of all FTP passing vehicles), and an ST passing group (the PP's, consisting of the remainder of all FTP passing vehicles) will estimate the cut-point for the $E_c = \gamma\%$ technique.

Since STE is the ratio of FF to total FTP failures, the technique STE = α is equivalent to adjusting the ST cut-point so that the percentage of FF vehicles is equal to $\alpha \cdot F\%$ of all the vehicles, or $\alpha\%$ of the FTP failing vehicles. The value of the ST, which divides the FTP failing vehicles into an ST failing group (the FF's, consisting of $\alpha\%$ of all FTP failing vehicles) and an ST passing group (the E_o's, consisting of the remainder of the FTP failing vehicles) will estimate the cut-point for the STE = α technique.

The technique $E_c/(E_c + FF) = \beta$ is substantially different from the other three techniques discussed above. This technique requires that the E_c rate be equal to $\beta\%$ of the ST failure rate. At first glance, this technique appears similar to the $E_c = \gamma\%$ and the STE = α techniques. However, as E_c is adjusted, the ST failure rate $(E_c + FF)$ changes, and the calculation of a new E_c rate depends both on E_c and FF. Therefore, cut-point estimation for this technique cannot be based solely upon the ST observations or a portion of these observations, as can be done for the other three techniques.

In conclusion, the techniques STRR = 1.0, STE = α, and $E_c = \gamma\%$ are technically similar in that the same estimation procedure is used to determine cut-points (i.e., quantiles of the ST measurements). However, each technique requires a different application of this procedure: for STRR = 1.0, the procedure is applied to all vehicles; for STE = α, the procedure is applied to the FTP failing vehicles; and for $E_c = \gamma$, the procedure is applied to the FTP passing vehicles. The remaining technique, based upon $E_c/(E_c + FF)$ requires the use of alternative methods of estimating cut-points. This alternative method is discussed in Section 5.1.1.2.4.

5.1.1.2 Statistical Estimation Procedures

The procedures which were employed to estimate the ST cut-point (Reference Section 3.1) fall into two broad categories: parametric and non-parametric estimation. Parametric method assumed the distribution of the ST and FTP values to be either normal or log-normal. The non-parametric method was distribution-free in that no assumption was made about the shape of the distribution of the ST and FTP values.

For each type of cut-point estimate, an estimate of the error in the cut-point can be made. For a parametric ST cut-point estimate, a standard error can be calculated parametrically, and for a non-parametric ST cut-point estimate, an error can be calculated non-parametrically.

The calculation of standard errors based upon a parametric model was not pursued.

The two non-parametric procedures available for estimating standard errors fall under small sample procedures and large sample (asymptotic) procedures. Both are based upon the order statistics of the sample and are briefly reviewed in Section 5.1.1.2.1. The small sample procedures are equivalent to forming confidence interval estimates for population quantiles and are discussed in Section 5.1.1.2.2. The asymptotic or large sample methods are described in Section 5.1.1.2.3.

5.1.1.2.1 Order Statistics

Suppose a sample of N vehicles is drawn from a population and an ST measurement of a pollutant's emission is made for each vehicle. Denote this collection of measurements as $X_1, X_2, \ldots, X_K, \ldots, X_N$ where X_K is the measurement associated with the K-th vehicle. If these sample values are ordered,

$$X_{(1)} \leq X_{(2)} \leq \cdots \leq X_{(K)} \leq \cdots \leq X_{(N)}$$

(the notation X_K is distinct from $X_{(K)}$: whereas X_K means the value for the K-th vehicle, $X_{(K)}$ means the K-th smallest value), the number of vehicles with values below $X_{(K)}$ is K-1 and the number of vehicles with values greater than or equal to $X_{(K)}$ is N - K + 1. Therefore, for STRR = 1, $X_{(K*)}$ is the ST value which will estimate the cut-point where K* is chosen to be the largest integer satisfying

$$\frac{N - K* + 1}{N} \leq \frac{F\%}{100}$$

$X_{(K*)}$ is said to estimate the F-quantile of the population.

The value of $X_{(K*)}$ will change from one data set to another even if the number of vehicles in each data set is the same and the ST is the same. If the statistical distribution of $X_{(K*)}$ can be found, the variance of $X_{(K*)}$ and hence the standard error of the estimate can be calculated. The exact statistical distribution which describes the variation of the values of $X_{(K*)}$ is considerably more complex (in the mathematical sense), due to the ordering, than the distribution which describes the variation of the values of X_K. Furthermore, the distribution of $X_{(K*)}$ is functionally dependent upon the distribution of X_K.

As the sample size becomes extremely large, the asymptotic distribution of $X_{(K*)}$ is normally distributed, although it depends on the distribution of X_K in a simple manner. If the asymptotic assumption can be applied, the distribution of X_K can be estimated from the sample values, and the distribution of $X_{(K*)}$ can be approximated. If the asymptotic assumption does not apply, the confidence interval approach can be applied if variance estimates are desired.

5.1.1.2.2 Confidence Interval Estimates for Population Quantiles

Let Q_F be the true (population) value of a quantile of order F%. An α % confidence interval estimate of Q_F is constructed by finding two numbers r and s, where $r < s$, such that the probability is α % that $(X_{(r)} < Q_F < X_{(s)})$. This probability is given by (Reference 4):

$$\sum_{i=r}^{s-1} \binom{N}{i} f^i (1-f)^{N-i}, \quad f = \frac{F\%}{100\%}, \quad N = \text{sample size} \tag{5-1}$$

By setting Equation (5-1) equal to (α %/100%), r and s can be found such that s - r is a minimum and $r \leq K^* < s$.

This procedure should be implemented and accompany non-parametric estimates of the ST cut-points as were described in the previous section. The difficulty with this procedure is that there is no convenient way to relate the length of the confidence interval to the sample size. Note that Equation (5-1) describes a relation between r, s, and the sample size N, not a relation between the interval length and the sample size. This will of course make difficult the design of experimental trials to estimate cut-points with a precision based upon the value of the cut-point; i.e., ± 10% of the estimate.

5.1.1.2.3 Large Sample Approximations

As the sample size approaches infinity and $\frac{N - K^* + 1}{N}$ remains fixed, the distribution of $X_{(K^*)}$ approaches the normal distribution (Reference 4) with mean Q_F and variance

$$\frac{f(1-f)}{N} \, g(Q_F)^{-2} \tag{5-2}$$

where g is the probability density of ST values X_K, Q_F is the F-quantile, and f is defined in Equation (5-1).

Thus, the estimate $X_{(K^*)}$ of Q_F (as described in Section 5.1.1.2.1) has an asymptotic standard error of

$$\frac{1}{|g(Q_F)|} \sqrt{\frac{f(1-f)}{N}} \tag{5-3}$$

The difficulty associated with Equation (5-3) is that knowledge of g is required. Otherwise, the relation between the standard error and sample size expressed in Equation (5-3) is suitable for sizing experiments for determining ST cut-points.

Notice that knowledge of g is generally adequate when asymptotic assumptions apply. Also, to apply Equation (5-3) for a single quantile, only $g(Q_F)$ need be approximated. This is occasionally, depending on the quantile to be estimated, much easier than approximating g over its entire range.

For sizing experiments generally, a range for $g(Q_F)$ is estimated and through the use of Equation (5-3) a range for the sample size can be extracted. After the sample sizes have been estimated, the appropriateness of the asymptotic assumption can be examined. For example, a sample size estimate of 400 vehicles in the 151 to 256 CID range would probably yield statistics closely following the large sample approximations. However, any estimate of sample size less than 50 may require small sample techniques.

5.1.1.2.4 Procedures Implemented

For each ST cut-point selection technique, non-parametric and parametric cut-point estimates were made as described in Section 3.1. Additionally, Equation (5-3) was used to estimate the standard error of the cut-point estimates. The density function, g, in Equation (5-3) was based on the normal or log-normal density function, depending upon which best described the data. The exact version of Equation (5-3) used for each technique is listed below.

a) STRR = 1.0: g is the density function for the ST measurements, f is the probability of ST failure; i.e., F%/100% and N are the total number of vehicles in the group.

b) $E_c = \gamma$ %: g is the density function for the ST measurements of the FTP passing vehicles, f is the probability of an E_c, given the vehicle passed the FTP; i.e., γ/P. N is the total number of vehicles passing the FTP.

c) STE = α : g is the density function for the ST measurements of the FTP failing vehicles, f is α (the probability of an FF, given the vehicle failed the FTP). N is the total number of vehicles failing the FTP.

d) $E_c/(E_c + FF) = \beta$: g is the density function for the ST measurements and f is $\beta \cdot (E_c + FF)$ at the solution point which is determined iteratively. N is the total number of vehicles.

To this point, the only source of variability that has been assumed is the variability of the ST measurements. However, the FTP measurements vary from vehicle to vehicle. For example, when using the technique STRR = 1.0, it is necessary to estimate the FTP failure rate F% from the sample data. The F% estimate is subject to statistical fluctuations, hence the standard error as given by Equation (5-3) (which assumes F% is fixed) will be underestimated. In the case of E_c or STE based policies, the situation is worse, since the densities, g, are based on FTP passing or FTP failing vehicles, respectively, and hence are subject to a greater degree of statistical fluctuation. Again, Equation (5-3) will tend to underestimate the standard error of the ST cut-point.

To assess the degree to which the ST standard error is underestimated, two computations were performed. Using Equation (5-4) from Volume I, the standard error of the percent of vehicles failing the individual FTP pollutants was calculated for each CID group. The results for the 300-car fleet are shown in Table 234. The standard errors of the estimated percent of vehicles passing are equal to those shown in Table 234 due to the symmetry of Equation (5-4) of Volume 1.

A standard error for the FTP standard or cut-point was computed using Equation (5-3) where f is F%/100% and g is the density function of the FTP measurements. The results for the 300-car fleet are shown in Table 235 for each CID group. These errors represent the "fuzziness" of the standards to each data set.

5.1.1.3 Contingency Table Parameters

The standard errors associated with E_c, E_o, FF, and PP are parametrically computed by calculating E_c, E_o, FF, and PP at the four combinations of the ST cut-point ± one of its standard errors and the FTP cut-point ± one of its standard errors. The maximum difference of each parameter (E_c, E_o, FF, and PP) was divided by 2 and used as the estimate of the standard error of the corresponding parameter. This method allows for the computation of symmetric confidence intervals based upon an estimate of the standards. Note that this error includes both ST and FTP fluctuations. Errors based upon only the ST fluctuations are computed by fixing the FTP cut-poont exactly at the standard.

5.1.2 Multiple Constituent Results

See the discussion in Section 3.2 and Section 5.2.2 of Volume I.

5.2 ERROR ESTIMATES FOR 300-CAR FLEET

Shown in Tables 236 and 237 are the Federal Short Cycle and Federal Three-mode ST cut-points and their standard errors for each technique on the pooled fleet of 300 cars. Care must be exercised in comparing errors between technique types, since the "N" in Equation (5-3) varies among techniques. However, the general trends discussed in Section 5.2.1 of Volume I and shown in Figure 5-1 are demonstrated.

In the case of STE = 0.6, 0.7, and 0.8, as the ST cut-point increases, so does the standard error. This phenomenon demonstrates the dependency between the level of the ST cut-point and its standard error (N is fixed for this technique).

For the technique STRR = 1.0, "N" from Equation (5-3) was equal to 300. The cut-points estimated under this technique have the lowest possible standard error for that cut-point. This clearly shows the influence of the sample size in controlling the cut-point error.

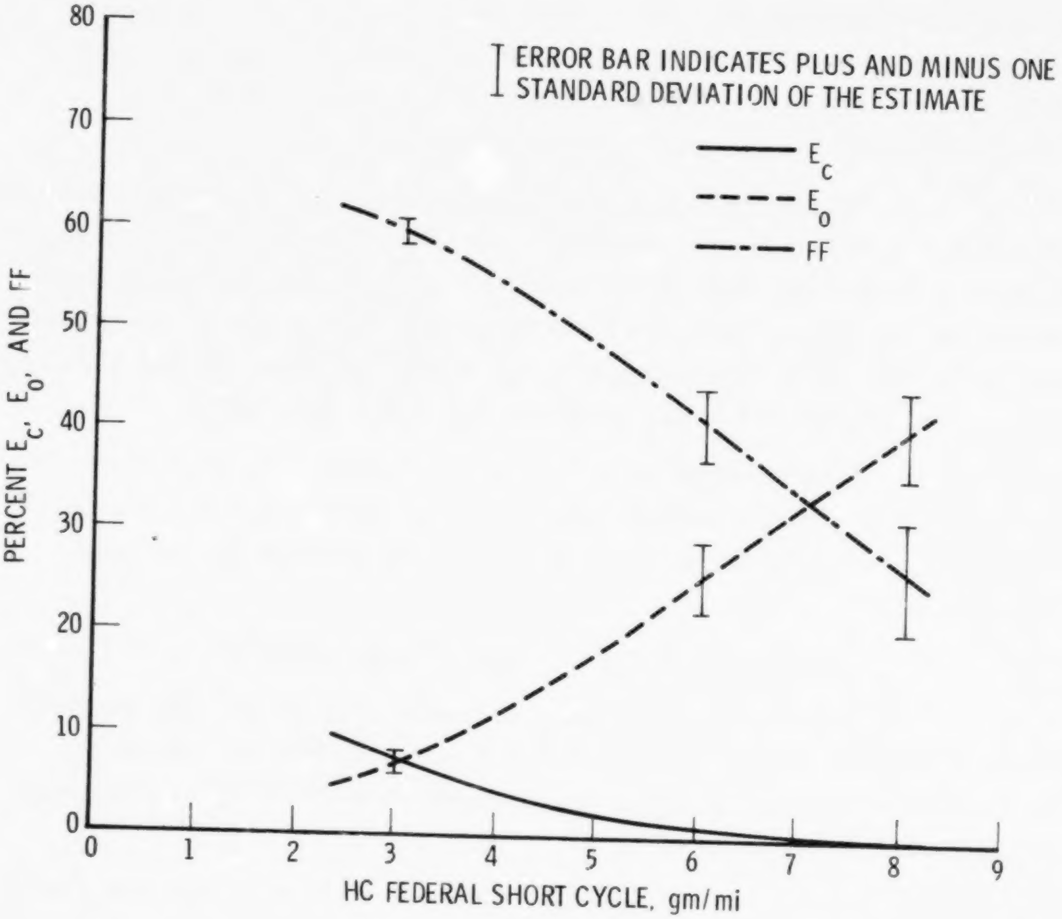


Figure 5-1. Typical Variability of Predicted Population Results

Tables 238 and 239 compare the standard errors for the Federal Short Cycle and Federal Three-mode ST cut-points on the basis of CID groups under the STRR = 1.0 technique. Not only does N change among vehicle groups for these tabulations, but the density g also changes (primarily due to changes in the means and variances among the CID groups). However, functional changes are also possible; i.e., changes between normal and log-normal models.

Using the variability in F% as shown in Table 234 to compute the change in the radical in Equation (5-3), the ST cut-point errors shown in Tables 238 and 239 for the 300-car fleet are underestimated by about 3% for HC, 0.3% for CO, and 4% for NO_x. Similarly, the ST cut-point errors for the 151 to 259 CID group, as shown in Tables 238 and 239, are underestimated by 6% for HC, 0.7% for CO, and 9% for NO_x.

The standard errors of the contingency table parameters were calculated for the technique STRR = 1.0 and are shown in Tables 240 and 241 for the Federal Short Cycle and the Federal Three-mode, respectively.

5.3 ERROR ESTIMATES FOR 117-CAR FLEET

The FTP failure rates estimated for the 117-car fleet are shown in Table 242 with their associated standard errors. Shown in Table 243 are the standard errors associated with the FTP standards as applied to the 117-vehicle fleet.

The ST cut-points for STRR = 1.0 (pooled fleet) and their standard errors are shown in Table 244 for both ST. Tables 245 and 246 show the corresponding contingency table parameters and their associated standard errors for the Federal Short Cycle and Federal Three-mode, respectively.

Based upon the variability of the FTP failure rate errors, the ST cut-points shown in Table 244 are underestimated by about 3% for HC, 12% for CO, and 16% for NO_x.

5.4 DISCUSSION OF RESULTS

The normalized dispersions, Equation (5-4),

$$\frac{\text{Standard Error}}{\text{Cut-point Value}} \qquad (5\text{-}4)$$

were computed for both ST and both fleets and are shown in Table 247 for the STRR = 1.0 technique. For the 300-car fleet, the estimated procedures are comparable for the two ST, whereas for the 117-car fleet the Federal Three-mode shows more variation, particularly on CO. The effect of sample size, although confounded by different cut-points in the two fleets, is primarily responsible for the increased dispersion in the ST cut-points of the 117-car fleet.

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2. Federal Test Procedure and Short Test Correlation Analyses, EPA-360/3-76-011, April 1976
3. Short Test Correlation Analyses on 300, 1975 Model Year Cars, Volume I, EPA-460/3-76-010a, October 1976
4. Gibbons, J. D., Non-parametric Statistical Inference, McGraw-Hill, New York, 1971

APPENDIX OF TABLES

Table 1. Cross Tabulation of Vehicles by Number of Cylinders and Engine Displacement - Denver[a]

Number of Cylinders	Engine Displacement		
	150 CID[b] or Less	151 to 259 CID	260 CID or Greater
4	33	0	0
6	0	18	0
8	0	0	66

[a] 117 vehicles total

[b] CID = cubic inch displacement

Table 2. Cross Tabulation of Vehicles by Inertia Test Weight and Engine Displacement - Denver

Inertia Test Weight Group (lb)	Engine Displacement			Total Number of Vehicles
	150 CID[a] or Less	151 to 259 CID	260 CID or Greater	
2500 or less	16	1	0	17
2501 to 3500	17	15	8	40
3501 to 4500	0	2	42	44
4501 or Greater	0	0	16	16
	33	18	66	117

[a] CID = cubic inch displacement

Table 3. Cross Tabulation of Vehicles by Engine Displacement and Emission Control System Type - Denver

CID(a)	Catalyst(b)				Total Number of Vehicles
	Yes		No		
	Secondary Air(c)		Secondary Air		
	Yes	No	Yes	No	
150 or Less	6	4	16	7	33
151 to 259	4	7	3	4	18
260 or More	26	39	1	0	66
	36	50	20	11	117

(a) CID = cubic inch displacement

(b) Oxidation catalyst

(c) Secondary air injection system

Table 4. Cross Tabulation of Vehicles by Inertia Test Weight and Emission Control System Type - Denver

Inertia Test Weight Group (lb)	Catalyst(a)				Total Number of Vehicles
	Yes		No		
	Secondary Air(b)		Secondary Air		
	Yes	No	Yes	No	
2500 or Less	3	0	8	6	17
2501 to 3500	12	14	10	4	40
3501 to 4500	15	26	2	1	44
4501 or Greater	6	10	0	0	16
	36	50	20	11	117

(a) Oxidation catalyst

(b) Secondary air injection system

Table 5. Cross Tabulation of Vehicles by Fuel System and Emission Control System Type - Denver

Fuel System Type	Catalyst[(a)]				Total Number of Vehicles
	Yes		No		
	Secondary Air[(b)]		Secondary Air		
	Yes	No	Yes	No	
Fuel Injection	1	0	4	5	10
Carburetion	35	50	16	6	107
	36	50	20	11	117

[(a)] Oxidation catalyst

[(b)] Secondary air injection system

Table 6. Cross Tabulation of Vehicles by Inertia Test Weight and Fuel System Type - Denver

Inertia Test Weight Group (lb)	Fuel System Type		Total Number of Vehicles
	Fuel Injection	Carburetion	
0 to 2500	6	11	17
2501 to 3500	2	38	40
3501 to 4500	2	42	44
4501 or Greater	0	16	16
	10	107	117

Table 7. Cross Tabulation of Vehicles by Engine Displacement and Fuel System Type - Denver

CID[a] Group	Fuel System Type		Total Number of Vehicles
	Injection	Carburetion	
150 or Less	7	26	33
151 to 259	2	16	18
260 or More	1	65	66
	10	107	117

[a] CID = cubic inch displacement

Table 8. Cross Tabulation of Vehicles by Engine Displacement and Transmission Type - Denver

CID[a] Group	Transmission Type		Total Number of Vehicles
	Automatic	Manual	
150 or Less	9	24	33
151 to 259	12	6	18
260 or More	66	0	66
	87	30	117

[a] CID = cubic inch displacement

Table 9. Cross Tabulation of Vehicles by Inertia Weight and Transmission Type - Denver

Inertia Test Weight Group (lb)	Transmission Type		Total Number of Vehicles
	Automatic	Manual	
0 to 2500	3	14	17
2501 to 3500	25	15	40
3501 to 4500	43	1	44
4501 or Greater	16	0	16
	87	30	117

Table 10. Cross Tabulation of Vehicles by Manufacturer and Engine Displacement - Denver

Manufacturer	Engine Displacement			Total Number of Vehicles
	150 CID[a] or Less	151 to 259 CID	260 CID or Greater	
General Motors	4	5	31	40
Ford	2	4	19	25
Chrysler	0	2	13	15
American Motors	0	4	2	6
Datsun	4	0	0	4
Toyota	3	0	0	3
VW, Audi, Porsche	6	1	0	7
Honda	2	0	0	2
Others	12	2	1	15
	33	18	66	117

[a] CID = cubic inch displacement

Table 11. FTP Means and Standard Deviations by City - Four Cities

City	Number of Vehicles	FTP Emissions (grams/mile)					
		HC		CO		NO_x	
		Mean	Standard	Mean	Standard	Mean	Standard
Chicago	100	1.283	.834	21.665	17.145	2.375	.896
Houston	100	1.534	1.335	27.598	32.812	2.446	1.050
Phoenix	100	1.288	.930	22.934	21.378	2.357	.974
Denver	117	2.282	1.413	48.638	37.580	1.691	.859

Table 12. Correlation Coefficient Summary - Denver

ST	Mode	Number of Vehicles	ST/FTP Correlation Coefficient(1)					
			HC	CO	NO_x	Log (HC)	Log (CO)	Log (NO_x)
Federal Short Cycle		118	.81	.86	.88	.82	.82	.86
Federal Three-mode	High	117	.50	.60	.64	.52	.58	.63
	Low	117	.51	.61	.70	.60	.61	.64
	Neutral	117	.31	.65	.28	.59	.60	.28
	Drive	87	.74	.62	.24	.68	.58	.29

(1) Correlation Coefficients are statistically significant at the 95% confidence level except where indicated by an asterisk.

Table 13. FTP Means and Standard Deviations by Engine Displacement - Denver

CID	Number of Vehicles	FTP Emissions (grams/mile)					
		HC		CO		NO_x	
		Mean	Standard	Mean	Standard	Mean	Standard
Less than 150	33	2.24	1.00	35.89	20.6	1.57	0.803
150 to 260	18	1.81	0.888	34.74	19.1	1.91	0.830
Greater than 260	66	2.43	1.67	58.8	44.4	1.69	0.894

Table 14. Correlation Coefficient Summary by Engine Displacement - Denver

Short Test	CID	Mode	Number of Vehicles	ST/FTP Correlation Coefficients [1] HC	CO	NO_x	Log (HC)	Log (CO)	Log (NO_x)
Federal Short Cycle	All		117	.81	.86	.82	.82	.82	.86
	150 or Less		33	.70	.70	.90	.84	.75	.90
	151 to 259		18	.40*	.55	.97	.66	.73	.97
	260 or More		66	.93	.88	.85	.86	.85	.81
Federal Three-mode	All	High	117	.50	.60	.64	.52	.58	.63
		Low	117	.51	.61	.70	.60	.61	.64
		Neutral	117	.31	.65	.28	.59	.60	.28
		Drive	87	.74	.62	.24	.68	.58	.29
	150 or Less	High	33	.21*	.33*	.66	.23*	.46	.79
		Low	33	.39	.50	.69	.46	.61	.80
		Neutral	33	.17*	.63	.15*	.39	.64	.29*
		Drive	9	.49*	.76	.52	.48*	.53*	.56*
	151 to 259	High	16	.24*	.25*	.72	.51	.46*	.75
		Low	16	.56	.51	.67	.72	.62	.84
		Neutral	16	-.01*	.73	.49	.40*	.64	.54
		Drive	12	.70	.60	.30*	.72	.59	.32*
	260 or More	High	66	.64	.72	.76	.67	.69	.60
		Low	66	.59	.69	.73	.65	.64	.53
		Neutral	66	.77	.77	.25	.78	.67	.19*
		Drive	66	.78	.63	.13*	.71	.60	.15*

[1] Correlation Coefficients are statistically significant at the 95% confidence level except where indicated by an asterisk.

Table 15. FTP Means and Standard Deviations by Inertia Test Weight - Denver

Inertia Test Weight Group	Number of Vehicles	FTP Emissions (grams/mile)					
		HC		CO		NO_x	
		Mean	Standard	Mean	Standard	Mean	Standard
2500 lb or Less	17	2.15	.927	31.5	14.5	1.74	.830
2501 to 3500 lb	40	2.03	1.08	36.6	24.1	1.68	.787
3501 to 4500 lb	44	2.50	1.75	60.6	46.8	1.73	1.05
4501 lb or Greater	16	2.45	1.53	63.9	39.1	1.53	.384

Table 16. Correlation Coefficient Summary by Inertia Test Weight Group - Denver

Short Test	Inertia Weight (lb)	Mode	Number of Vehicles	ST/FTP Correlation Coefficients(1)					
				HC	CO	NO_x	Log (HC)	Log (CO)	Log (NO_x)
Federal Short Cycle	All		117	.81	.86	.82	.82	.82	.86
	0 to 2500		17	.84	.92	.94	.93	.92	.92
	2501 to 3500		40	.70	.69	.90	.77	.71	.91
	3501 to 4500		44	.89	.91	.88	.81	.87	.85
	4501 or More		16	.93	.77	.72	.90	.81	.68
Federal Three-mode	All	High	117	.50	.60	.64	.52	.58	.63
		Low	117	.51	.61	.70	.60	.61	.64
		Neutral	117	.31	.65	.28	.59	.60	.28
		Drive	87	.74	.62	.24	.68	.58	.29
	0 to 2500	High	17	.36*	.41*	.47*	.40*	.31*	.66
		Low	17	.65	.65	.43*	.77	.63	.54
		Neutral	17	.08*	.50	-.27*	.53	.62	-.23*
		Drive	3	.37*	.97*	-.17*	.53*	.94*	.10*
	2501 to 3500	High	40	.20*	.27*	.68	.33	.55	.67
		Low	40	.33	.39	.75	.42	.59	.82
		Neutral	40	.39	.72	.50	.52	.72	.43
		Drive	25	.71	.68	.44	.77	.75	.46
	3501 to 4500	High	44	.59	.73	.80	.72	.72	.78
		Low	44	.58	.73	.75	.73	.62	.67
		Neutral	44	.24*	.74	.30*	.56	.60	.34
		Drive	43	.78	.68	.11*	.69	.56	.19*
	4501 or More	High	16	.84	.84	.63	.71	.62	.47*
		Low	16	.91	.78	.62	.90	.71	.44*
		Neutral	16	.96	.92	-.11*	.96	.71	.04*
		Drive	16	.91	.75	-.01*	.80	.63	.08*

(1) Correlation Coefficients are statistically significant at the 95% confidence level except where indicated by an asterisk.

Table 17. FTP Means and Standard Deviations by Emission Control System - Denver

Catalyst	Secondary Air-Injection	Number of Vehicles	FTP Emissions (grams/mile)					
			HC		CO		NO_x	
			Mean	Standard	Mean	Standard	Mean	Standard
Yes	Yes	36	1.90	1.89	44.6	50.3	1.69	.946
Yes	No	50	2.63	1.25	61.7	32.6	1.61	.770
No	Yes	20	2.03	.873	32.7	12.0	1.58	.889
No	No	11	2.42	.541	31.6	18.2	2.27	.776

Table 18. Correlation Coefficient Summary by Emission Control System Type - Denver

Short Test	Catalyst / Secondary Air	Mode	Number of Vehicles	ST/FTP Correlation Coefficients(1)					
				HC	CO	NO_x	Log (HC)	Log (CO)	Log (NO_x)
Federal Short Cycle	All		117	.81	.86	.82	.82	.82	.86
	Yes/Yes		36	.95	.96	.94	.87	.82	.87
	Yes/No		50	.83	.76	.82	.80	.83	.83
	No/Yes		20	.74	.43*	.92	.71	.79	.92
	No/No		11	.91	.73	.94	.92	.84	.94
Federal Three-mode	All	High	117	.50	.60	.64	.52	.58	.63
		Low	117	.51	.61	.70	.60	.61	.64
		Neutral	117	.31	.65	.28	.59	.60	.28
		Drive	87	.74	.62	.24	.68	.58	.29
	Yes/Yes	High	36	.64	.61	.83	.64	.71	.72
		Low	36	.52	.66	.84	.75	.77	.60
		Neutral	36	.85	.65	.25*	.79	.81	.17*
		Drive	31	.85	.55	.39	.81	.76	.29*
	Yes/No	High	50	.46	.55	.55	.36	.38	.40
		Low	50	.56	.60	.73	.52	.51	.61
		Neutral	50	.70	.75	.36	.62	.60	.33
		Drive	47	.64	.78	.15*	.58	.57	.26*
	No/Yes	High	20	.19*	.63	.72	.33*	.73	.83
		Low	20	.22*	.48	.70	.36*	.63	.75
		Neutral	20	-.10*	.53	-.05*	.08*	.69	.12*
		Drive	4	.90*	.64*	.65*	.95	.44*	.72*
	No/No	High	11	-.32*	.37*	.28*	-.35*	.39*	.32*
		Low	11	.09*	.34*	.43*	-.03*	.34*	.55*
		Neutral	11	.54*	.43*	.09*	.45*	.70	.07*
		Drive	5	-.88*	.30*	.75*	-.90	.61*	.72*

(1)Correlation Coefficients are statistically significant at the 95% confidence level except where indicated by an asterisk.

Table 19. FTP Means and Standard Deviations by Manufacturer - Denver

Manufacturer	Number of Vehicles	FTP Emissions (grams/mile)					
		HC		CO		NO_x	
		Mean	Standard	Mean	Standard	Mean	Standard
GM	40	2.14	1.21	51.0	32.4	1.59	.836
Ford	25	2.11	2.11	51.9	56.8	1.57	.505
Chrysler	15	3.32	1.17	74.7	33.2	1.76	.407
AMC	6	1.91	.85	31.9	22.2	3.24	1.69
Others	31	2.17	.936	33.6	16.4	1.59	.820

Table 21. FTP Means and Standard Deviations by Transmission Type - Denver

Transmission	Number of Vehicles	FTP Emissions (grams/mile)					
		HC		CO		NO_x	
		Mean	Standard	Mean	Standard	Mean	Standard
Automatic	87	2.30	1.53	54.5	41.1	1.75	.869
Manual	30	2.21	1.02	31.6	15.4	1.51	.818

Table 20. Correlation Coefficient Summary by Manufacturer - Denver

Short Test	Manufacturer	Mode	Number of Vehicles	ST/FTP Correlation Coefficients[1]					
				HC	CO	NO_x	Log (HC)	Log (CO)	Log (NO_x)
Federal Short Cycle	All		117	.81	.86	.82	.82	.82	.86
	GM		40	.84	.78	.91	.83	.87	.87
	Ford		25	.99	.97	.73	.94	.91	.78
	Chrysler		15	.76	.91	.82	.66	.76	.82
	AMC		6	.97	.90	.97	.98	.92	.98
	Others		31	.63	.48	.91	.70	.57	.91
Federal Three-mode	All	High	117	.50	.60	.64	.52	.58	.63
		Low	117	.51	.61	.70	.60	.61	.64
		Neutral	117	.31	.65	.28	.59	.60	.28
		Drive	87	.74	.62	.24	.68	.58	.29
	GM	High	40	.62	.65	.63	.57	.69	.37
		Low	40	.72	.75	.81	.69	.70	.59
		Neutral	40	.80	.73	-.41	.68	.54	.38
		Drive	38	.69	.73	.22*	.60	.54	.36
	Ford	High	25	.75	.77	.65	.78	.65	.70
		Low	25	.61	.78	.54	.75	.66	.59
		Neutral	25	.89	.74	.04*	.78	.75	.08*
		Drive	22	.84	.49	.02*	.78	.68	.14*
	Chrysler	High	15	.49*	.68	.35*	.52	.32*	.29*
		Low	15	.23*	.52	.43*	.25*	.40*	.45*
		Neutral	15	.60	.80	.02*	.78	.90	.04*
		Drive	14	.54	.92	-.12*	.75	.86	-.08*
	AMC	High	6	.30*	.95	.75*	.39*	.96	.75*
		Low	6	.48*	.86	.65*	.64*	.93	.67*
		Neutral	6	.63*	.72*	-.23*	.84	.93	-.10*
		Drive	5	.64*	.92	.22*	.84*	.96	.47*
	Others	High	31	.23*	.54	.67	.27*	.51	.83
		Low	31	.34*	.62	.68	.48	.66	.76
		Neutral	31	.02*	.50	.05*	.26*	.62	.19*
		Drive	8	.53*	.53*	-.20*	.53*	.53*	-.15*

[1] Correlation Coefficients are statistically significant at the 95% confidence level except where indicated by an asterisk.

Table 22. Correlation Coefficient Summary by Transmission - Denver

Short Test	Transmission	Mode	Number of Vehicles	ST/FTP Correlation Coefficients(1)					
				HC	CO	NO_x	Log (HC)	Log (CO)	Log (NO_x)
Federal Short Cycle	All		117	.81	.86	.82	.82	.82	.86
	Automatic		87	.92	.88	.86	.85	.85	.84
	Manual		30	.61	.53	.95	.73	.66	.94
Federal Three-mode	All	High	117	.50	.60	.64	.52	.58	.63
		Low	117	.51	.61	.70	.60	.61	.64
		Neutral	117	.31	.65	.28	.59	.60	.28
		Drive	87	.74	.62	.24	.68	.58	.29
	Automatic	High	87	.57	.64	.71	.61	.62	.57
		Low		.54	.66	.74	.65	.66	.59
		Neutral		.75	.72	.32	.75	.66	.32
		Drive		.74	.62	.24	.68	.58	.29
	Manual	High	30	.27*	.38	.73	.30*	.46	.84
		Low		.42	.48	.63	.49	.55	.77
		Neutral		.01*	.60	.19*	.25*	.60	.33*
		Drive		-	-	-	-	-	-

(1) Correlation Coefficients are statistically significant at the 95% confidence level except where indicated by an asterisk.

Table 23. FTP Means and Standard Deviations by Fuel System Type - Denver

Fuel Injection	Number of Vehicles	FTP Emissions (grams/mile)					
		HC		CO		NO_x	
		Mean	Standard	Mean	Standard	Mean	Standard
Yes	10	2.23	.722	31.5	18.1	1.62	.744
No	107	2.28	1.46	50.2	38.6	1.70	.872

Table 24. Correlation Coefficient Summary by Fuel System Type - Denver

Short Test	Fuel Injection	Mode	Number of Vehicles	ST/FTP Correlation Coefficients(1)					
				HC	CO	NO_x	Log (HC)	Log (CO)	Log (NO_x)
Federal Short Cycle	All		117	.81	.86	.82	.82	.82	.86
	Yes		10	.03*	.90	.95	.15*	.93	.95
	No		107	.84	.86	.88	.84	.82	.85
Federal Three-mode	All	High	117	.50	.60	.64	.52	.58	.63
		Low	117	.51	.61	.70	.60	.61	.64
		Neutral	117	.31	.65	.28	.59	.60	.28
		Drive	87	.74	.62	.24	.68	.58	.29
	Yes	High	10	.44*	.80	.80	.62*	.51*	.83
		Low	10	.70	.75	.86	.78	.64	.73
		Neutral	10	-.05*	.21*	.51*	.08*	.53*	.62*
		Drive	3	.90*	.62*	.13*	.90*	.77*	.08*
	No	High	107	.50	.60	.64	.51	.60	.61
		Low	107	.51	.61	.69	.60	.62	.63
		Neutral	107	.44	.67	.27	.64	.64	.26
		Drive	84	.74	.62	.24	.68	.60	.29

(1) Correlation Coefficients are statistically significant at the 95% confidence level except where indicated by an asterisk.

Table 25. FTP Means and Standard Deviation by Mileage Group - Denver

Mileage Group	Number of Vehicles	Emissions (grams/mile)					
		HC		CO		NO_x	
		Mean	Standard	Mean	Standard	Mean	Standard
4000 Miles or Less	7	1.98	1.50	32.4	33.1	0.857	0.231
Greater than 4000 Miles	110	2.30	1.41	49.7	37.7	1.74	0.858

Table 26. Correlation Coefficient Summary by Accumulated Mileage - Denver

Short Test	Mileage Group	Mode	Number of Vehicles	ST/FTP Correlation Coefficients[(1)]					
				HC	CO	NO_x	Log (HC)	Log (CO)	Log (NO_x)
Federal Short Cycle	All		117	.81	.86	.82	.82	.82	.86
	4000 or Less		7	.88	.67*	.83	.71*	.66*	.81
	Greater than 4000		110	.88	.88	.88	.84	.83	.86
Federal Three-mode	All	High	117	.50	.60	.64	.52	.58	.63
		Low	117	.51	.61	.70	.60	.61	.64
		Neutral	117	.31	.65	.28	.59	.60	.28
		Drive	87	.74	.62	.24	.68	.58	.29
	4000 or Less	High	7	-.12*	-.10*	.83	.05*	.47*	.81
		Low	7	-.26*	.01*	.79	-.31*	.36*	.80
		Neutral	7	.23*	.76	.39*	.14*	.87	.45*
		Drive	3	.997*	.999	.93*	.97*	.99*	.96*
	Greater than 4000	High	110	.52	.62	.62	.57	.57	.60
		Low	110	.58	.67	.68	.70	.63	.60
		Neutral	110	.32	.65	.26	.62	.56	.27
		Drive	84	.74	.60	.24	.66	.55	.66

(1) Correlation Coefficients are statistically significant at the 95% confidence level except where indicated by an asterisk.

TABLE 27

SUMMARY OF CONTINGENCY TABLE ANALYSIS-- HC
GROUPED BY CID
FEDERAL SHORT CYCLE - 117 CAR FLEET (DENVER)
METHOD OF BOUNDED ERRORS OF COMMISSION: EC= 5%

CID	NO. OF VEHICLES	MODE	CUT POINTS ST UNITS	CUT POINTS FTP UNITS	% CORRECT FAILURES	% EC	% EO	STE	STRR	EC/(EC+FF)	FTP AVG FOR ST PASS	FTP AVG FOR ST FAIL	CORRE- LATION
ALL	117		1.06	1.82	52.96	5.00	15.10	0.78	0.85	0.09	1.29	2.82	0.5871
CID <= 150	33		0.89	1.92	61.34	5.00	11.88	0.84	0.91	0.08	1.22	2.56	0.6100
150 TO 260	18		1.28	1.84	27.29	5.00	26.75	0.50	0.60	0.15	1.45	2.38	0.4223
CID >= 260	66		1.07	1.68	57.91	5.00	11.58	0.83	0.91	0.08	1.33	3.02	0.6383

TABLE 28

SUMMARY OF CONTINGENCY TABLE ANALYSIS-- HC
GROUPED BY CID
FEDERAL THREE-MODE - 117 CAR FLEET (DENVER)
METHOD OF BOUNDED ERRORS OF COMMISSION; EC= 5%

CID	NO. OF VEHICLES	MODE	CUT POINTS ST UNITS	CUT POINTS FTP UNITS	% CORRECT FAILURES	% EC	% EO	STE	STRR	EC/(EC+FF)	FTP AVG FOR ST PASS	FTP AVG FOR ST FAIL	CORRE-LATION
ALL	117	H	86.78	2.27	32.59	5.00	35.58	0.48	0.55	0.13	1.83	2.85	0.3086
	117	L	89.33	2.17	37.63	5.00	30.55	0.55	0.63	0.12	1.59	2.94	0.3719
	117	D	167.58	2.22	33.30	5.00	34.87	0.49	0.56	0.13	1.72	2.96	0.3175
	117	N	132.89	2.19	36.72	5.00	31.45	0.54	0.61	0.12	1.73	3.01	0.3605
CID <= 150	33	H	123.35	2.34	25.77	5.00	51.08	0.34	0.40	0.16	2.15	2.40	0.1091
	33	L	126.66	2.32	36.23	5.00	40.62	0.47	0.54	0.12	1.90	2.63	0.2189
	33	D	221.02	2.22	29.30	5.00	44.48	0.40	0.46	0.15	2.07	2.49	0.1913
	33	N	168.41	2.20	32.12	5.00	41.66	0.44	0.50	0.13	2.04	2.58	0.2227
150 TO 260	18	H	123.70	1.98	15.54	5.00	48.17	0.24	0.32	0.24	1.84	1.64	0.1263
	18	L	91.68	1.79	30.88	5.00	23.16	0.57	0.66	0.14	1.41	2.44	0.4807
	18	D	322.89	1.81	15.61	5.00	38.43	0.29	0.38	0.24	1.75	2.31	0.2219
	18	N	281.85	1.81	15.78	5.00	38.26	0.29	0.38	0.24	1.75	2.31	0.2250
CID >= 260	66	H	69.69	2.12	43.65	5.00	25.84	0.63	0.70	0.10	1.55	3.22	0.4277
	66	L	77.38	2.17	42.30	5.00	27.19	0.61	0.68	0.11	1.63	3.34	0.4103
	66	D	113.53	1.95	46.38	5.00	23.11	0.67	0.74	0.10	1.51	3.35	0.4639
	66	N	87.08	1.87	51.48	5.00	18.00	0.74	0.81	0.09	1.48	3.27	0.5360

TABLE 29

SUMMARY OF CONTINGENCY TABLE ANALYSIS-- CO
GROUPED BY CID
FEDERAL SHORT CYCLE - 117 CAR FLEET (DENVER)
METHOD OF BOUNDED ERRORS OF COMMISSION; EC= 5%

CID	NO. OF VEHICLES	MODE	CUT POINTS ST UNITS	CUT POINTS FTP UNITS	% CORRECT FAILURES	% EC	% EO	STE	STRR	EC/(EC+FF)	FTP AVG FOR ST PASS	FTP AVG FOR ST FAIL	CORRE-LATION
ALL	117		3.28	22.28	88.52	5.00	2.25	0.98	1.03	0.05	21.73	50.88	0.5095
CID <= 150	33		6.01	22.50	81.94	5.00	6.52	0.93	0.98	0.06	18.53	39.74	0.4676
150 TO 260	18		3.70	26.08	76.12	5.00	10.06	0.88	0.94	0.06	28.76	35.93	0.4597
CID >= 260	66		1.73	23.17	93.51	5.00	0.21	1.00	1.05	0.05	9.66	60.34	0.4038

TABLE 30

SUMMARY OF CONTINGENCY TABLE ANALYSIS-- CO
GROUPED BY CID
FEDERAL THREE-MODE - 117 CAR FLEET (DENVER)
METHOD OF BOUNDED ERRORS OF COMMISSION; EC= 5%

CID	NO. OF VEHICLES	MODE	CUT POINTS ST UNITS	CUT POINTS FTP UNITS	% CORRECT FAILURES	% EC	% EO	STE	STRR	EC/(EC+FF)	FTP AVG FOR ST PASS	FTP AVG FOR ST FAIL	CORRE- LATION
ALL	117	H	1978.06	26.25	81.94	5.00	8.83	0.90	0.96	0.06	25.60	52.83	0.3100
	117	L	1191.10	28.21	82.91	5.00	7.86	0.91	0.97	0.06	25.17	54.38	0.3299
	117	D	984.23	28.03	81.10	5.00	9.67	0.89	0.95	0.06	29.70	55.47	0.2942
	117	N	674.82	27.44	82.71	5.00	8.06	0.91	0.97	0.06	28.27	55.98	0.3256
CID <= 150	33	H	17373.87	35.42	47.70	5.00	36.81	0.56	0.62	0.09	26.26	48.94	0.1751
	33	L	11520.56	32.16	59.06	5.00	25.45	0.70	0.76	0.08	22.00	47.45	0.2836
	33	D	2910.54	22.92	77.79	5.00	10.67	0.88	0.94	0.06	17.19	40.04	0.3776
	33	N	2114.90	25.45	77.65	5.00	10.81	0.88	0.93	0.06	17.07	40.95	0.3751
150 TO 260	18	H	19583.11	34.92	43.43	5.00	41.47	0.51	0.57	0.10	32.88	37.65	0.1293
	18	L	1049.13	28.75	70.39	5.00	15.79	0.82	0.87	0.07	20.79	41.71	0.3644
	18	D	9772.40	29.03	64.75	5.00	20.15	0.76	0.82	0.07	21.80	42.97	0.3364
	18	N	1940.52	23.49	73.85	5.00	11.05	0.87	0.93	0.06	21.80	42.97	0.4724
CID >= 260	66	H	7556.57	36.36	70.83	5.00	12.95	0.85	0.91	0.07	34.40	67.96	0.4625
	66	L	6753.17	39.03	69.05	5.00	14.74	0.82	0.88	0.07	32.11	69.60	0.4337
	66	D	11836.14	43.49	65.66	5.00	18.13	0.78	0.84	0.07	33.74	77.28	0.3848
	66	N	104.14	28.65	92.49	5.00	1.23	0.99	1.04	0.05	0.00	58.81	0.2960

TABLE 31

SUMMARY OF CONTINGENCY TABLE ANALYSIS-- NOX
GROUPED BY CID
FEDERAL SHORT CYCLE - 117 CAR FLEET (DENVER)
METHOD OF BOUNDED ERRORS OF COMMISSION; EC= 5%

CID	NO. OF VEHICLES	MODE	CUT POINTS ST UNITS	CUT POINTS FTP UNITS	% CORRECT FAILURES	% EC	% EO	STE	STRR	EC7(EC+FF)	FTP AVG FOR ST PASS	FTP AVG FOR ST FAIL	CORRE-LATION
ALL	117		2.54	2.66	4.19	5.00	1.48	0.74	1.62	0.54	1.52	3.52	0.5490
CID <= 150	33		2.19	2.56	4.69	5.00	1.03	0.82	1.70	0.52	1.49	4.10	0.6022
150 TO 260	18		2.99	2.85	7.42	5.00	0.23	0.97	1.62	0.40	1.72	3.47	0.7380
CID >= 260	66		2.52	2.67	2.78	5.00	1.26	0.69	1.93	0.64	1.52	3.76	0.4673

TABLE 32

SUMMARY OF CONTINGENCY TABLE ANALYSIS-- NOX
GROUPED BY CID
FEDERAL THREE-MODE - 117 CAR FLEET (DENVER)
METHOD OF BOUNDED ERRORS OF COMMISSION; EC= 5%

CID	NO. OF VEHICLES	MODE	CUT POINTS ST UNITS	CUT POINTS FTP UNITS	% CORRECT FAILURES	% EC	% EO	STE	STRR	EC/(EC+FF)	FTP AVG FOR ST PASS	FTP AVG FOR ST FAIL	CORRE-LATION
ALL	117	H	2226.67	2.75	2.32	5.00	3.34	0.41	1.29	0.68	1.60	2.92	0.3164
	117	L	1567.75	2.93	2.34	5.00	3.33	0.41	1.30	0.68	1.60	4.19	0.3187
	117	D	262.73	2.03	0.90	5.00	4.76	0.16	1.04	0.85	1.66	2.01	0.1043
	117	N	108.25	2.19	0.85	5.00	4.81	0.15	1.03	0.85	1.64	2.72	0.0958
CID <= 150	33	H	2674.86	2.53	3.52	5.00	2.20	0.62	1.49	0.59	1.55	1.99	0.4676
	33	L	1198.68	2.42	1.54	5.00	1.33	0.54	2.28	0.76	1.50	2.31	0.3273
	33	D	97.86	1.82	0.33	5.00	2.54	0.12	1.86	0.94	1.60	1.30	0.0475
	33	N	102.08	1.81	0.87	5.00	4.84	0.15	1.03	0.85	1.60	1.13	0.0983
150 TO 260	18	H	2211.37	2.87	5.87	5.00	5.77	0.50	0.93	0.46	1.80	2.85	0.4611
	18	L	1589.43	2.69	3.35	5.00	4.30	0.44	1.09	0.60	1.90	2.18	0.3692
	18	D	447.11	2.51	4.07	5.00	7.57	0.35	0.78	0.55	1.80	2.85	0.3271
	18	N	120.14	2.51	2.02	5.00	5.63	0.26	0.92	0.71	1.90	2.16	0.2186
CID >= 260	66	H	1863.41	3.15	1.59	5.00	2.45	0.39	1.63	0.76	1.54	4.86	0.2715
	66	L	1399.00	2.90	1.31	5.00	2.73	0.32	1.56	0.79	1.54	3.56	0.2202
	66	D	281.31	1.95	0.40	5.00	3.64	0.10	1.34	0.93	1.69	1.60	0.0401
	66	N	101.04	2.19	0.46	5.00	3.58	0.11	1.35	0.92	1.63	3.58	0.0530

TABLE 33

SUMMARY OF CONTINGENCY TABLE ANALYSIS-- CMP3
GROUPED BY CID
FEDERAL SHORT CYCLE - 117 CAR FLEET (DENVER)
METHOD OF BOUNDED ERRORS OF COMMISSION: EC= 5%

CID	NO. OF VEHICLES	MODE	CUT POINTS ST UNITS	CUT POINTS FTP UNITS	% CORRECT FAILURES	% EC	% EO	STE	STRR	EC/(EC+FF)	FTP AVG FOR ST PASS	FTP AVG FOR ST FAIL	CORRE-LATION
ALL	117				88.89	5.98	2.56	0.97	1.04	0.06			0.3447
CID <= 150	33				84.85	0.00	9.09	0.90	0.90	0.00			0.6011
150 TO 260	18				77.78	5.56	5.56	0.93	1.00	0.07			0.6000
CID >= 260	66				92.42	6.06	0.00	1.00	1.07	0.06			0.4332

TABLE 34

SUMMARY OF CONTINGENCY TABLE ANALYSIS-- CMP3
GROUPED BY CID
FEDERAL THREE-MODE - 117 CAR FLEET (DENVER)
METHOD OF BOUNDED ERRORS OF COMMISSION; EC= 5%

CID	NO. OF VEHICLES	MODE	CUT POINTS ST UNITS	CUT POINTS FTP UNITS	% CORRECT FAILURES	% EC	% EO	STE	STRR	EC/(EC+FF)	FTP AVG FOR ST PASS	FTP AVG FOR ST FAIL	CORRELATION
ALL	117	H			85.47	0.85	5.98	0.93	0.94	0.01			0.6791
	117	L			82.05	0.85	9.40	0.90	0.91	0.01			0.5920
	117	D			76.07	3.42	15.38	0.83	0.87	0.04			0.2990
	117	N			74.36	1.71	17.09	0.81	0.83	0.02			0.4017
					81.20	0.85	10.26	0.89	0.90	0.01			0.5740
CID <= 150	33	H			63.64	0.00	30.30	0.68	0.68	0.00			0.3360
	33	L			66.67	0.00	27.27	0.71	0.71	0.00			0.3592
	33	D			81.82	3.03	12.12	0.87	0.90	0.04			0.2469
	33	N			78.79	3.03	15.15	0.84	0.87	0.04			0.2095
					75.76	0.00	18.18	0.81	0.81	0.00			0.4490
150 TO 260	18	H			50.00	0.00	33.33	0.60	0.60	0.00			0.4472
	18	L			61.11	5.56	22.22	0.73	0.80	0.08			0.3162
	18	D			55.56	11.11	27.78	0.67	0.80	0.17			0.0000
	18	N			61.11	5.56	22.22	0.73	0.80	0.08			0.3162
					50.00	0.00	33.33	0.60	0.60	0.00			0.4472
CID >= 260	66	H			80.30	0.00	12.12	0.87	0.87	0.00			0.5781
	66	L			77.27	0.00	15.15	0.84	0.84	0.00			0.5279
	66	D			60.61	1.52	31.82	0.66	0.67	0.02			0.2486
	66	N			92.42	7.58	0.00	1.00	1.08	0.08			INDEF
					83.33	0.00	9.09	0.90	0.90	0.00			0.6402

TABLE 35

SUMMARY OF CONTINGENCY TABLE ANALYSIS-- HC
GROUPED BY CID
FEDERAL SHORT CYCLE - 300 CAR FLEET
FIXED SHORT TEST REJECTION RATIO; STRR= 100%

CID	NO. OF VEHICLES	MODE	CUT POINTS ST UNITS	CUT POINTS FTP UNITS	% CORRECT FAILURES	% EC	% EO	STE	STRR	EC/(EC+FF)	FTP AVG FOR ST PASS	FTP AVG FOR ST FAIL	CORRE- LATION
ALL	300		1.04	1.40	22.70	9.01	9.01	0.72	1.00	0.28	0.92	2.22	0.5840
CID <= 150	95		1.03	1.35	23.16	8.98	8.98	0.72	1.00	0.28	1.00	1.97	0.5884
150 TO 260	54		0.96	1.41	17.51	9.76	9.76	0.64	1.00	0.36	1.03	1.83	0.5080
CID >= 260	151		1.07	1.42	24.20	8.69	8.69	0.74	1.00	0.26	0.82	2.45	0.6062

TABLE 36

SUMMARY OF CONTINGENCY TABLE ANALYSIS-- HC
GROUPED BY CID
FEDERAL 3-MODE - 300 CAR FLEET
FIXED SHORT TEST REJECTION RATIO; STRR= 100%

CID	NO. OF VEHICLES	MODE	CUT POINTS ST UNITS	CUT POINTS FTP UNITS	% CORRECT FAILURES	% EC	% EO	STE	STRR	EC/(EC+FF)	FTP AVG FOR ST PASS	FTP AVG FOR ST FAIL	CORRE-LATION
ALL	300	H	55.04	1.39	14.03	17.57	17.57	0.44	1.00	0.56	1.21	1.76	0.1870
	300	L	57.88	1.42	15.87	15.74	15.74	0.50	1.00	0.50	1.14	1.92	0.2720
	300	D	112.27	1.37	19.01	12.70	12.70	0.60	1.00	0.40	0.99	2.15	0.4136
	300	N	105.28	1.36	18.27	13.44	13.44	0.58	1.00	0.42	1.00	2.17	0.3794
CID <= 150	95	H	62.90	1.35	15.08	17.06	17.06	0.47	1.00	0.53	1.23	1.49	0.2179
	95	L	65.09	1.36	16.61	15.52	15.52	0.52	1.00	0.48	1.17	1.65	0.2884
	95	D	124.10	1.31	18.16	13.98	13.98	0.57	1.00	0.43	1.09	1.87	0.3591
	95	N	105.20	1.32	17.08	15.05	15.05	0.53	1.00	0.47	1.09	1.82	0.3098
150 TO 260	54	H	54.92	1.32	10.09	17.18	17.18	0.37	1.00	0.63	1.09	1.78	0.1340
	54	L	69.90	1.33	12.43	14.84	14.84	0.46	1.00	0.54	1.11	1.65	0.2518
	54	D	137.81	1.35	14.42	12.85	12.85	0.53	1.00	0.47	1.07	1.86	0.3523
	54	N	122.23	1.33	13.51	13.76	13.76	0.50	1.00	0.50	1.07	1.91	0.3062
CID >= 260	151	H	50.65	1.44	14.80	17.90	17.90	0.45	1.00	0.55	1.27	1.94	0.1868
	151	L	50.21	1.49	16.83	15.86	15.86	0.51	1.00	0.49	1.13	2.18	0.2791
	151	D	96.89	1.40	21.23	11.66	11.66	0.65	1.00	0.35	0.87	2.43	0.4718
	151	N	100.05	1.39	20.48	12.41	12.41	0.62	1.00	0.38	0.93	2.49	0.4379

TABLE 37

SUMMARY OF CONTINGENCY TABLE ANALYSIS-- HC
GROUPED BY CID
FEDERAL SHORT CYCLE - 300 CAR FLEET
EC/(EC+FF) = 10% AND 20%: EC/(EC+FF)= 10%

CID	NO. OF VEHICLES	MODE	CUT POINTS ST UNITS	CUT POINTS FTP UNITS	% CORRECT FAILURES	% EC	% EO	STE	STRR	EC/(EC+FF)	FTP AVG FOR ST PASS	FTP AVG FOR ST FAIL	CORRELATION
ALL	300		2.06	2.26	10.89	1.21	20.82	0.34	0.38	0.10	1.14	3.18	0.4647
CID <= 150	95		1.90	1.78	11.47	1.27	20.66	0.36	0.40	0.10	1.23	2.79	0.4735
150 TO 260	54		2.65	2.78	4.33	0.48	22.94	0.16	0.18	0.10	1.21	2.75	0.3168
CID >= 260	151		2.01	2.41	13.28	1.48	19.61	0.40	0.45	0.10	1.06	3.22	0.5058

TABLE 38

SUMMARY OF CONTINGENCY TABLE ANALYSIS-- HC
GROUPED BY CID
FEDERAL 3-MODE - 300 CAR FLEET
EC/(EC+FF) = 10% AND 20%: EC/(EC+FF)= 10%

CID	NO. OF VEHICLES	MODE	CUT POINTS ST UNITS	CUT POINTS FTP UNITS	% CORRECT FAILURES	% EC	% EO	STE	STRR	EC/(EC+FF)	FTP AVG FOR ST PASS	FTP AVG FOR ST FAIL	CORRE-LATION
ALL	300	H		***** PRACTICAL SOLUTION DOES NOT EXIST *****									
	300	L		***** PRACTICAL SOLUTION DOES NOT EXIST *****									
	300	D	572.65	3.42	1.73	0.19	29.98	0.05	0.06	0.10	1.35	3.14	0.1754
	300	N		***** PRACTICAL SOLUTION DOES NOT EXIST *****									
CID <= 150	95	H		***** PRACTICAL SOLUTION DOES NOT EXIST *****									
	95	L		***** PRACTICAL SOLUTION DOES NOT EXIST *****									
	95	D		***** PRACTICAL SOLUTION DOES NOT EXIST *****									
	95	N		***** PRACTICAL SOLUTION DOES NOT EXIST *****									
150 TO 260	54	H		***** PRACTICAL SOLUTION DOES NOT EXIST *****									
	54	L		***** PRACTICAL SOLUTION DOES NOT EXIST *****									
	54	D		***** PRACTICAL SOLUTION DOES NOT EXIST *****									
	54	N		***** PRACTICAL SOLUTION DOES NOT EXIST *****									
CID >= 260	151	H		***** PRACTICAL SOLUTION DOES NOT EXIST *****									
	151	L		***** PRACTICAL SOLUTION DOES NOT EXIST *****									
	151	D	353.06	3.32	4.42	0.49	28.47	0.13	0.15	0.10	1.42	1.85	0.2761
	151	N	467.71	3.22	2.84	0.32	30.05	0.09	0.10	0.10	1.41	2.13	0.2194

TABLE 39

SUMMARY OF CONTINGENCY TABLE ANALYSIS-- HC -CONTINUED
GROUPED BY CID
FEDERAL SHORT CYCLE - 300 CAR FLEET
EC/(EC+FF) = 10% AND 20%: EC/(EC+FF)= 20%

CID	NO. OF VEHICLES	MODE	CUT POINTS ST UNITS	CUT POINTS FTP UNITS	% CORRECT FAILURES	% EC	% EO	STE	STRR	EC/(EC+FF)	FTP AVG FOR ST PASS	FTP AVG FOR ST FAIL	CORRE- LATION
ALL	300		1.37	1.68	17.99	4.50	13.72	0.57	0.71	0.20	1.02	2.59	0.5590
CID <= 150	95		1.31	1.49	18.68	4.67	13.45	0.58	0.73	0.20	1.07	2.28	0.5657
150 TO 260	54		1.66	1.99	9.50	2.38	17.77	0.35	0.44	0.20	1.17	2.54	0.4347
CID >= 260	151		1.33	1.69	20.60	5.15	12.29	0.63	0.78	0.20	0.93	2.65	0.5905

TABLE 40

SUMMARY OF CONTINGENCY TABLE ANALYSIS-- HC -CONTINUED
GROUPED BY CID
FEDERAL 3-MODE - 300 CAR FLEET
EC/(EC+FF) = 10% AND 20%: EC/(EC+FF)= 20%

CID	NO. OF VEHICLES	MODE	CUT POINTS ST UNITS	CUT POINTS FTP UNITS	% CORRECT FAILURES	% EC	% EO	STE	STRR	EC/(EC+FF)	FTP AVG FOR ST PASS	FTP AVG FOR ST FAIL	CORRE-LATION
ALL	300	H		***** PRACTICAL SOLUTION DOES NOT EXIST *****									
	300	L		***** PRACTICAL SOLUTION DOES NOT EXIST *****									
	300	D	298.12	2.19	6.09	1.52	25.61	0.19	0.24	0.20	1.25	2.39	0.2980
	300	N	345.00	2.28	4.09	1.02	27.61	0.13	0.16	0.20	1.32	2.06	0.2410
CID <= 150	95	H		***** PRACTICAL SOLUTION DOES NOT EXIST *****									
	95	L		***** PRACTICAL SOLUTION DOES NOT EXIST *****									
	95	D	455.95	2.24	3.20	0.80	28.93	0.10	0.12	0.20	1.26	2.39	0.2094
	95	N	524.38	2.32	1.27	0.32	30.86	0.04	0.05	0.20	1.30	2.06	0.1303
150 TO 260	54	H		***** PRACTICAL SOLUTION DOES NOT EXIST *****									
	54	L		***** PRACTICAL SOLUTION DOES NOT EXIST *****									
	54	D	470.11	2.59	1.72	0.43	25.55	0.06	0.08	0.20	1.27	0.00	0.1757
	54	N		***** PRACTICAL SOLUTION DOES NOT EXIST *****									
CID >= 260	151	H		***** PRACTICAL SOLUTION DOES NOT EXIST *****									
	151	L		***** PRACTICAL SOLUTION DOES NOT EXIST *****									
	151	D	195.41	2.14	10.85	2.71	22.04	0.33	0.41	0.20	1.15	2.66	0.3973
	151	N	242.14	2.09	8.39	2.10	24.50	0.26	0.32	0.20	1.21	2.65	0.3432

TABLE 41

SUMMARY OF CONTINGENCY TABLE ANALYSIS-- HC
GROUPED BY CID
FEDERAL SHORT CYCLE - 300 CAR FLEET
METHOD OF BOUNDED ERRORS OF COMMISSION: EC= 5%

CID	NO. OF VEHICLES	MODE	CUT POINTS ST UNITS	CUT POINTS FTP UNITS	% CORRECT FAILURES	% EC	% EO	STE	STRR	EC/(EC+FF)	FTP AVG FOR ST PASS	FTP AVG FOR ST FAIL	CORRE- LATION
ALL	300		1.32	1.64	18.68	5.00	13.03	0.59	0.75	0.21	1.01	2.51	0.5646
CID <= 150	95		1.28	1.48	19.13	5.00	13.00	0.60	0.75	0.21	1.07	2.24	0.5693
150 TO 260	54		1.27	1.67	13.31	5.00	13.96	0.49	0.67	0.27	1.13	2.39	0.4830
CID >= 260	151		1.35	1.71	20.40	5.00	12.49	0.62	0.77	0.20	0.93	2.65	0.5891

TABLE 42

SUMMARY OF CONTINGENCY TABLE ANALYSIS-- HC
GROUPED BY CID
FEDERAL 3-MODE - 300 CAR FLEET
METHOD OF BOUNDED ERRORS OF COMMISSION; EC= 5%

CID	NO. OF VEHICLES	MODE	CUT POINTS ST UNITS	CUT POINTS FTP UNITS	% CORRECT FAILURES	% EC	% EO	STE	STRR	EC/(EC+FF)	FTP AVG FOR ST PASS	FTP AVG FOR ST FAIL	CORRE-LATION
ALL	300	H	92.48	1.62	5.43	5.00	26.17	0.17	0.33	0.48	1.27	2.12	0.1503
	300	L	92.75	1.79	7.48	5.00	24.12	0.24	0.39	0.40	1.20	2.37	0.2300
	300	D	183.79	1.69	11.90	5.00	19.81	0.38	0.53	0.30	1.14	2.27	0.3751
	300	N	181.25	1.65	10.72	5.00	20.98	0.34	0.50	0.32	1.18	2.26	0.3388
CID <= 150	95	H	106.89	1.54	6.24	5.00	25.89	0.19	0.35	0.44	1.28	1.70	0.1784
	95	L	105.32	1.63	8.07	5.00	24.06	0.25	0.41	0.38	1.22	1.98	0.2458
	95	D	219.49	1.58	10.21	5.00	21.92	0.32	0.47	0.33	1.20	2.09	0.3173
	95	N	192.09	1.52	8.68	5.00	23.45	0.27	0.43	0.37	1.21	2.01	0.2670
150 TO 260	54	H	91.97	1.56	3.69	5.00	23.58	0.14	0.32	0.58	1.20	1.96	0.1051
	54	L	110.34	1.57	5.95	5.00	21.32	0.22	0.40	0.46	1.15	2.08	0.2130
	54	D	212.65	1.63	8.43	5.00	18.83	0.31	0.49	0.37	1.15	1.81	0.3142
	54	N	210.37	1.66	7.23	5.00	20.04	0.27	0.45	0.41	1.15	1.81	0.2669
CID >= 260	151	H	83.42	1.65	5.65	5.00	27.05	0.17	0.33	0.47	1.30	2.71	0.1498
	151	L	78.62	2.04	7.97	5.00	24.73	0.24	0.40	0.39	1.22	3.00	0.2365
	151	D	150.51	1.80	14.61	5.00	18.27	0.44	0.60	0.25	1.08	2.49	0.4376
	151	N	165.39	1.71	13.29	5.00	19.60	0.40	0.56	0.27	1.09	2.58	0.4005

TABLE 43

SUMMARY OF CONTINGENCY TABLE ANALYSIS-- HC
GROUPED BY CID
FEDERAL SHORT CYCLE - 300 CAR FLEET
FIXED SHORT TEST EFFECTIVENESS; STE= 60%

CID	NO. OF VEHICLES	MODE	CUT POINTS ST UNITS	CUT POINTS FTP UNITS	% CORRECT FAILURES	% EC	% EO	STE	STRR	EC/(EC+FF)	FTP AVG FOR ST PASS	FTP AVG FOR ST FAIL	CORRELATION
ALL	300		1.29	1.62	19.02	5.27	12.68	0.60	0.77	0.22	1.00	2.50	0.5673
CID <= 150	95		1.27	1.47	19.28	5.12	12.85	0.60	0.76	0.21	1.07	2.24	0.5705
150 TO 260	54		1.04	1.48	16.36	8.20	10.91	0.60	0.90	0.33	1.06	1.88	0.5041
CID >= 260	151		1.40	1.77	19.73	4.52	13.16	0.60	0.74	0.19	0.93	2.72	0.5839

TABLE 44

SUMMARY OF CONTINGENCY TABLE ANALYSIS-- HC
GROUPED BY CID
FEDERAL 3-MODE - 300 CAR FLEET
FIXED SHORT TEST EFFECTIVENESS; STE= 60%

CID	NO. OF VEHICLES	MODE	CUT POINTS ST UNITS	CUT POINTS FTP UNITS	% CORRECT FAILURES	% EC	% EO	STE	STRR	EC/(EC+FF)	FTP AVG FOR ST PASS	FTP AVG FOR ST FAIL	CORRELATION
ALL	300	H	42.70	1.31	18.96	27.13	12.64	0.60	1.46	0.59	1.20	1.62	0.1897
	300	L	49.25	1.32	18.96	21.23	12.64	0.60	1.27	0.53	1.10	1.80	0.2747
	300	D	112.14	1.37	19.02	12.72	12.68	0.60	1.00	0.40	0.99	2.15	0.4136
	300	N	99.71	1.34	19.02	14.59	12.68	0.60	1.06	0.43	0.98	2.08	0.3805
CID <= 150	95	H	50.33	1.29	19.28	24.81	12.85	0.60	1.37	0.56	1.21	1.47	0.2205
	95	L	56.50	1.30	19.28	20.07	12.85	0.60	1.22	0.51	1.16	1.58	0.2908
	95	D	114.59	1.28	19.28	15.72	12.85	0.60	1.09	0.45	1.08	1.79	0.3606
	95	N	90.45	1.28	19.28	18.71	12.85	0.60	1.18	0.49	1.05	1.76	0.3120
150 TO 260	54	H	37.14	1.21	16.36	32.38	10.91	0.60	1.79	0.66	1.10	1.54	0.1379
	54	L	54.52	1.23	16.36	23.20	10.91	0.60	1.45	0.59	0.95	1.78	0.2559
	54	D	120.18	1.29	16.36	16.40	10.91	0.60	1.20	0.50	1.07	1.68	0.3553
	54	N	96.87	1.24	16.36	19.38	10.91	0.60	1.31	0.54	1.05	1.68	0.3099
CID >= 260	151	H	40.44	1.37	19.62	26.85	13.08	0.60	1.42	0.58	1.27	1.70	0.1891
	151	L	44.00	1.37	19.62	20.58	13.08	0.60	1.23	0.51	1.10	2.01	0.2815
	151	D	107.32	1.48	19.73	9.77	13.16	0.60	0.90	0.33	0.90	2.50	0.4681
	151	N	105.54	1.42	19.73	11.40	13.16	0.60	0.95	0.37	0.93	2.49	0.4364

TABLE 45

SUMMARY OF CONTINGENCY TABLE ANALYSIS-- HC -CONTINUED
GROUPED BY CID
FEDERAL SHORT CYCLE - 300 CAR FLEET
FIXED SHORT TEST EFFECTIVENESS; STE= 70%

CID	NO. OF VEHICLES	MODE	CUT POINTS ST UNITS	CUT POINTS FTP UNITS	% CORRECT FAILURES	% EC	% EO	STE	STRR	EC/(EC+FF)	FTP AVG FOR ST PASS	FTP AVG FOR ST FAIL	CORRELATION
ALL	300		1.07	1.43	22.19	8.38	9.51	0.70	0.96	0.27	0.94	2.25	0.5830
CID <= 150	95		1.07	1.37	22.49	8.17	9.64	0.70	0.95	0.27	1.02	2.00	0.5871
150 TO 260	54		0.85	1.33	19.09	12.32	8.18	0.70	1.15	0.39	1.01	1.62	0.5092
CID >= 260	151		1.15	1.51	23.02	7.34	9.87	0.70	0.92	0.24	0.84	2.52	0.6034

TABLE 46

SUMMARY OF CONTINGENCY TABLE ANALYSIS-- HC -CONTINUED
GROUPED BY CID
FEDERAL 3-MODE 300 CAR FLEET
FIXED SHORT TEST EFFECTIVENESS; STE= 70%

CID	NO. OF VEHICLES	MODE	CUT POINTS ST UNITS	CUT POINTS FTP UNITS	% CORRECT FAILURES	% EC	% EO	STE	STRR	EC/(EC+FF)	FTP AVG FOR ST PASS	FTP AVG FOR ST FAIL	CORRE-LATION
ALL	300	H	35.87	1.27	22.12	34.36	9.48	0.70	1.79	0.61	1.12	1.59	0.1853
	300	L	41.29	1.23	22.12	27.99	9.48	0.70	1.59	0.56	1.08	1.75	0.2704
	300	D	88.88	1.26	22.19	18.03	9.51	0.70	1.27	0.45	0.93	1.98	0.4137
	300	N	78.45	1.25	22.19	20.31	9.51	0.70	1.34	0.48	0.96	1.96	0.3790
CID <= 150	95	H	41.92	1.26	22.49	31.87	9.64	0.70	1.69	0.59	1.15	1.50	0.2160
	95	L	47.11	1.24	22.49	26.67	9.64	0.70	1.53	0.54	1.15	1.52	0.2868
	95	D	90.09	1.22	22[illegible]	21.64	9.64	0.70	1.37	0.49	1.01	1.69	0.3584
	95	N	71.53	1.24	2[illegible].49	25.12	9.64	0.70	1.48	0.53	1.05	1.68	0.3084
150 TO 260	54	H	30.98	1.17	19.09	40.16	8.18	0.70	2.17	0.68	1.13	1.39	0.1340
	54	L	45.32	1.18	19.09	30.43	8.18	0.70	1.82	0.61	0.94	1.65	0.2508
	54	D	97.94	1.20	19.09	22.60	8.18	0.70	1.53	0.54	1.04	1.63	0.3516
	54	N	76.39	1.16	19.09	26.10	8.18	0.70	1.66	0.58	1.08	1.52	0.3053
CID >= 260	151	H	34.33	1.33	22.89	33.98	9.81	0.70	1.74	0.60	1.12	1.64	0.1848
	151	L	37.30	1.24	22.89	27.21	9.81	0.70	1.53	0.54	1.10	1.91	0.2774
	151	D	85.21	1.32	23.02	14.32	9.87	0.70	1.14	0.38	0.85	2.42	0.4726
	151	N	82.77	1.30	23.02	16.38	9.87	0.70	1.20	0.42	0.88	2.28	0.4384

TABLE 47

SUMMARY OF CONTINGENCY TABLE ANALYSIS-- HC -CONTINUED
GROUPED BY CID
FEDERAL SHORT CYCLE - 300 CAR FLEET
FIXED SHORT TEST EFFECTIVENESS; STE= 80%

CID	NO. OF VEHICLES	MODE	CUT POINTS ST UNITS	CUT POINTS FTP UNITS	% CORRECT FAILURES	% EC	% EO	STE	STRR	EC/(EC+FF)	FTP AVG FOR ST PASS	FTP AVG FOR ST FAIL	CORRE- LATION
ALL	300		0.86	1.26	25.36	13.20	6.34	0.80	1.22	0.34	0.85	2.03	0.5800
CID <= 150	95		0.88	1.28	25.71	12.92	6.43	0.80	1.20	0.33	0.92	1.86	0.5848
150 TO 260	54		0.68	1.19	21.81	18.38	5.45	0.80	1.47	0.46	0.97	1.55	0.4971
CID >= 260	151		0.93	1.27	26.31	11.80	6.58	0.80	1.16	0.31	0.77	2.32	0.6039

TABLE 48

SUMMARY OF CONTINGENCY TABLE ANALYSIS-- HC -CONTINUED
GROUPED BY CID
FEDERAL 3-MODE - 300 CAR FLEET
FIXED SHORT TEST EFFECTIVENESS; STE= 80%

CID	NO. OF VEHICLES	MODE	CUT POINTS ST UNITS	CUT POINTS FTP UNITS	% CORRECT FAILURES	% EC	% EO	STE	STRR	EC/(EC+FF)	FTP AVG FOR ST PASS	FTP AVG FOR ST FAIL	CORRE-LATION
ALL	300	H	29.25	1.23	25.28	42.77	6.32	0.80	2.15	0.63	1.11	1.50	0.1742
	300	L	33.61	1.15	25.28	36.38	6.32	0.80	1.95	0.59	1.01	1.62	0.2564
	300	D	67.81	1.17	25.36	25.32	6.34	0.80	1.60	0.50	0.93	1.86	0.3995
	300	N	59.31	1.18	25.36	27.97	6.34	0.80	1.68	0.52	0.91	1.82	0.3642
CID <= 150	95	H	33.86	1.22	25.71	40.27	6.43	0.80	2.05	0.61	0.99	1.53	0.2037
	95	L	38.09	1.18	25.71	34.94	6.43	0.80	1.89	0.58	1.03	1.56	0.2726
	95	D	68.04	1.15	25.71	29.46	6.43	0.80	1.72	0.53	1.01	1.65	0.3436
	95	N	54.38	1.19	25.71	33.29	6.43	0.80	1.84	0.56	1.01	1.57	0.2939
150 TO 260	54	H	25.06	1.13	21.81	48.89	5.45	0.80	2.59	0.69	1.17	1.32	0.1251
	54	L	36.52	1.12	21.81	39.34	5.45	0.80	2.24	0.64	0.91	1.58	0.2368
	54	D	77.13	1.13	21.81	30.82	5.45	0.80	1.93	0.59	1.06	1.50	0.3356
	54	N	57.88	1.10	21.81	34.72	5.45	0.80	2.07	0.61	0.90	1.54	0.2898
CID >= 260	151	H	28.34	1.29	26.16	42.25	6.54	0.80	2.09	0.62	1.16	1.55	0.1738
	151	L	30.74	1.12	26.16	35.46	6.54	0.80	1.88	0.58	1.10	1.68	0.2635
	151	D	65.20	1.17	26.31	20.82	6.58	0.80	1.43	0.44	0.85	2.30	0.4610
	151	N	62.39	1.20	26.31	23.31	6.58	0.80	1.51	0.47	0.83	2.16	0.4253

TABLE 49

SUMMARY OF CONTINGENCY TABLE ANALYSIS-- CO
GROUPED BY CID
FEDERAL SHORT CYCLE - 300 CAR FLEET
FIXED SHORT TEST REJECTION RATIO: STRR= 100%

CID	NO. OF VEHICLES	MODE	CUT POINTS ST UNITS	CUT POINTS FTP UNITS	% CORRECT FAILURES	% EC	% EO	STE	STRR	EC/(EC+FF)	FTP AVG FOR ST PASS	FTP AVG FOR ST FAIL	CORRELATION
ALL	300		5.17	13.23	44.07	9.75	9.75	0.82	1.00	0.18	9.89	33.26	0.6078
CID <= 150	95		8.90	14.98	33.47	11.23	11.23	0.75	1.00	0.25	10.42	23.87	0.5456
150 TO 260	54		4.47	14.42	46.63	8.91	8.91	0.84	1.00	0.16	10.64	32.79	0.6391
CID >= 260	151		3.75	12.61	48.86	8.29	8.29	0.85	1.00	0.15	9.19	40.46	0.6616

TABLE 50

SUMMARY OF CONTINGENCY TABLE ANALYSIS-- CO
GROUPED BY CID
FEDERAL 3-MODE - 300 CAR FLEET
FIXED SHORT TEST REJECTION RATIO; STRR= 100%

CID	NO. OF VEHICLES	MODE	CUT POINTS ST UNITS	CUT POINTS FTP UNITS	% CORRECT FAILURES	% EC	% EO	STE	STRR	EC/(EC+FF)	FTP AVG FOR ST PASS	FTP AVG FOR ST FAIL	CORRELATION
ALL	300	H	625.02	20.87	33.73	21.32	21.32	0.61	1.00	0.39	22.42	25.57	0.1384
	300	L	638.06	19.59	35.90	19.20	19.20	0.65	1.00	0.35	19.54	28.08	0.2240
	300	D	2197.93	13.99	43.42	12.41	12.41	0.78	1.00	0.22	11.35	33.27	0.4966
	300	N	1972.38	13.93	42.76	13.19	13.19	0.76	1.00	0.24	11.86	32.79	0.4649
CID <= 150	95	H	2016.58	15.34	22.91	21.80	21.80	0.51	1.00	0.49	14.35	20.61	0.1182
	95	L	1905.48	15.34	25.57	19.13	19.13	0.57	1.00	0.43	13.58	20.21	0.2260
	95	D	5907.01	13.94	30.43	14.36	14.36	0.68	1.00	0.32	11.43	21.42	0.4191
	95	N	5162.46	14.05	29.20	15.60	15.60	0.65	1.00	0.35	11.97	20.94	0.3691
150 TO 260	54	H	339.65	19.61	33.72	24.72	24.72	0.58	1.00	0.42	23.91	20.21	-0.0178
	54	L	406.29	17.43	39.03	19.98	19.98	0.66	1.00	0.34	19.31	23.50	0.1739
	54	D	2446.02	14.29	47.26	12.19	12.19	0.79	1.00	0.21	11.71	30.34	0.4944
	54	N	2031.27	14.24	44.66	14.78	14.78	0.75	1.00	0.25	12.98	30.46	0.3868
CID >= 260	151	H	385.29	24.36	40.37	18.40	18.40	0.69	1.00	0.31	22.94	34.05	0.2405
	151	L	375.72	24.00	41.88	16.95	16.95	0.71	1.00	0.29	22.88	35.19	0.3001
	151	D	1121.24	13.01	50.00	9.91	9.91	0.83	1.00	0.17	10.92	44.29	0.5873
	151	N	1046.11	12.85	49.91	10.23	10.23	0.83	1.00	0.17	11.03	43.81	0.5733

TABLE 51

SUMMARY OF CONTINGENCY TABLE ANALYSIS-- CO
GROUPED BY CID
FEDERAL SHORT CYCLE - 300 CAR FLEET
EC/(EC+FF) = 10% AND 20%: EC/(EC+FF)= 10%

CID	NO. OF VEHICLES	MODE	CUT POINTS ST UNITS	CUT POINTS FTP UNITS	% CORRECT FAILURES	% EC	% EO	STE	STRR	EC/(EC+FF)	FTP AVG FOR ST PASS	FTP AVG FOR ST FAIL	CORRE-LATION
ALL	300		9.91	18.35	34.44	3.83	19.38	0.64	0.71	0.10	10.76	40.77	0.5714
CID <= 150	95		18.58	20.69	17.56	1.95	27.15	0.39	0.44	0.10	13.46	33.21	0.4485
150 TO 260	54		6.65	16.45	39.79	4.42	15.75	0.72	0.80	0.10	11.07	33.18	0.6173
CID >= 260	151		5.70	14.88	43.98	4.89	13.17	0.77	0.85	0.10	9.91	43.88	0.6489

TABLE 52

SUMMARY OF CONTINGENCY TABLE ANALYSIS-- CO
GROUPED BY CID
FEDERAL 3-MODE - 300 CAR FLEET
EC/(EC+FF) = 10% AND 20%: EC/(EC+FF)= 10%

CID	NO. OF VEHICLES	MODE	CUT POINTS ST UNITS	CUT POINTS FTP UNITS	% CORRECT FAILURES	% EC	% EO	STE	STRR	EC/(EC+FF)	FTP AVG FOR ST PASS	FTP AVG FOR ST FAIL	CORRE-LATION
ALL	300	H		***** PRACTICAL SOLUTION DOES NOT EXIST *****									
	300	L		***** PRACTICAL SOLUTION DOES NOT EXIST *****									
	300	D	12945.39	22.45	24.59	2.73	31.24	0.44	0.49	0.10	12.66	44.93	0.4219
	300	N	15615.30	25.89	20.80	2.31	35.14	0.37	0.41	0.10	14.26	52.46	0.3761
CID <= 150	95	H		***** PRACTICAL SOLUTION DOES NOT EXIST *****									
	95	L		***** PRACTICAL SOLUTION DOES NOT EXIST *****									
	95	D	79635.50	38.39	6.11	0.68	38.69	0.14	0.15	0.10	16.54	24.49	0.2453
	95	N	132754.13	60.99	2.93	0.33	41.87	0.07	0.07	0.10	16.79	0.00	0.1667
150 TO 260	54	H		***** PARAMETRIC SOLUTION DOES NOT EXIST *****									
	54	L		***** PRACTICAL SOLUTION DOES NOT EXIST *****									
	54	D	10476.20	18.42	29.58	3.29	29.87	0.50	0.55	0.10	13.31	37.21	0.4354
	54	N	26790.04	28.32	15.26	1.70	44.19	0.26	0.29	0.10	14.70	43.87	0.2812
CID >= 260	151	H		***** PRACTICAL SOLUTION DOES NOT EXIST *****									
	151	L	12984.52	50.90	4.71	0.52	54.12	0.08	0.09	0.10	25.34	82.22	0.1488
	151	D	2936.66	15.23	41.01	4.56	18.90	0.68	0.76	0.10	11.58	48.62	0.5617
	151	N	2979.88	15.43	39.90	4.43	20.24	0.66	0.74	0.10	11.67	48.02	0.5443

TABLE 53

SUMMARY OF CONTINGENCY TABLE ANALYSIS-- CO -CONTINUED
GROUPED BY CID
FEDERAL SHORT CYCLE - 300 CAR FLEET
EC/(EC+FF) = 10% AND 20%; EC/(EC+FF)= 20%

CID	NO. OF VEHICLES	MODE	CUT POINTS ST UNITS	CUT POINTS FTP UNITS	% CORRECT FAILURES	% EC	% EO	STE	STRR	EC/(EC+FF)	FTP AVG FOR ST PASS	FTP AVG FOR ST FAIL	CORRELATION
ALL	300		4.51	12.52	45.67	11.42	8.15	0.85	1.06	0.20	9.44	32.41	0.6057
CID <= 150	95		11.12	16.29	28.97	7.24	15.74	0.65	0.81	0.20	11.02	26.68	0.5348
150 TO 260	54		3.54	13.56	49.66	12.41	5.88	0.89	1.12	0.20	9.98	29.19	0.6297
CID >= 260	151		2.36	11.00	52.75	13.19	4.40	0.92	1.15	0.20	8.12	39.14	0.6424

TABLE 54

SUMMARY OF CONTINGENCY TABLE ANALYSIS-- CO -CONTINUED
GROUPED BY CID
FEDERAL 3-MODE - 300 CAR FLEET
EC/(EC+FF) = 10% AND 20%: EC/(EC+FF)= 20%

CID	NO. OF VEHICLES	MODE	CUT POINTS ST UNITS	CUT POINTS FTP UNITS	% CORRECT FAILURES	% EC	% EO	STE	STRR	EC/(EC+FF)	FTP AVG FOR ST PASS	FTP AVG FOR ST FAIL	CORRELATION
ALL	300	H	***** PRACTICAL SOLUTION DOES NOT EXIST *****										
	300	L	12470.65	41.22	5.37	1.34	49.73	0.10	0.12	0.20	21.04	68.88	0.1343
	300	D	2955.68	14.59	40.68	10.17	15.15	0.73	0.91	0.20	11.45	34.67	0.4951
	300	N	3249.72	15.05	37.96	9.49	17.98	0.68	0.85	0.20	12.03	35.79	0.4604
CID <= 150	95	H	***** PRACTICAL SOLUTION DOES NOT EXIST *****										
	95	L	***** PRACTICAL SOLUTION DOES NOT EXIST *****										
	95	D	21343.43	19.06	16.88	4.22	27.92	0.38	0.47	0.20	13.33	30.61	0.3661
	95	N	29910.23	23.15	11.60	2.90	33.20	0.26	0.32	0.20	13.99	36.17	0.2916
150 TO 260	54	H	***** PARAMETRIC SOLUTION DOES NOT EXIST *****										
	54	L	13563.11	41.79	3.27	0.82	55.74	0.06	0.07	0.20	18.22	81.16	0.0881
	54	D	2609.79	14.37	46.61	11.65	12.84	0.78	0.98	0.20	11.71	30.34	0.4946
	54	N	4458.96	15.62	36.01	9.00	23.43	0.61	0.76	0.20	13.81	33.21	0.3788
CID >= 260	151	H	3926.22	31.55	12.45	3.11	46.32	0.21	0.26	0.20	24.02	54.57	0.1852
	151	L	1763.00	26.96	22.41	5.60	36.42	0.38	0.48	0.20	22.54	46.38	0.2684
	151	C	702.62	12.50	53.23	13.31	6.69	0.89	1.11	0.20	10.29	43.22	0.5779
	151	N	693.10	12.38	52.85	13.21	7.29	0.88	1.10	0.20	10.38	43.16	0.5659

TABLE 55

SUMMARY OF CONTINGENCY TABLE ANALYSIS-- CO
GROUPED BY CID
FEDERAL SHORT CYCLE - 300 CAR FLEET
METHOD OF BOUNDED ERRORS OF COMMISSION: EC= 5%

CID	NO. OF VEHICLES	MODE	CUT POINTS ST UNITS	CUT POINTS FTP UNITS	% CORRECT FAILURES	% EC	% EO	STE	STRR	EC/(EC+FF)	FTP AVG FOR ST PASS	FTP AVG FOR ST FAIL	CORRELATION
ALL	300		8.40	16.71	37.14	5.00	16.68	0.69	0.78	0.12	10.61	38.84	0.5875
CID <= 150	95		13.10	17.45	25.36	5.00	19.35	0.57	0.68	0.16	11.95	28.37	0.5156
150 TO 260	54		6.24	16.07	40.99	5.00	14.55	0.74	0.83	0.11	11.07	33.18	0.6238
CID >= 260	151		5.61	14.77	44.19	5.00	12.96	0.77	0.86	0.10	9.91	43.88	0.6499

TABLE 56

SUMMARY OF CONTINGENCY TABLE ANALYSIS-- CO
GROUPED BY CID
FEDERAL 3-MODE - 300 CAR FLEET
METHOD OF BOUNDED ERRORS OF COMMISSION; EC= 5%

CID	NO. OF VEHICLES	MODE	CUT POINTS ST UNITS	CUT POINTS FTP UNITS	% CORRECT FAILURES	% EC	% EO	STE	STRR	EC/(EC+FF)	FTP AVG FOR ST PASS	FTP AVG FOR ST FAIL	CORRE-LATION
ALL	300	H	5042.09	26.32	10.63	5.00	44.42	0.19	0.28	0.32	20.87	41.28	0.1121
	300	L	3919.22	25.59	14.37	5.00	40.73	0.26	0.35	0.26	19.63	40.12	0.1881
	300	D	7080.58	17.83	31.39	5.00	24.44	0.56	0.65	0.14	12.23	39.34	0.4635
	300	N	7199.51	18.51	29.31	5.00	26.64	0.52	0.61	0.15	12.92	41.99	0.4292
CID <= 150	95	H	11087.38	20.42	6.68	5.00	38.03	0.15	0.26	0.43	15.97	23.77	0.0913
	95	L	7610.77	20.45	9.99	5.00	34.71	0.22	0.34	0.33	15.13	28.24	0.1853
	95	D	18382.12	18.08	18.43	5.00	26.37	0.41	0.52	0.21	13.18	28.77	0.3767
	95	N	18623.92	19.00	15.96	5.00	28.84	0.36	0.47	0.24	13.46	33.24	0.3245
150 TO 260	54	H	3934.06	25.46	6.51	5.00	51.93	0.11	0.20	0.43	20.37	44.64	-0.0137
	54	L	2903.17	22.05	14.06	5.00	44.95	0.24	0.32	0.26	17.79	44.28	0.1456
	54	D	7063.25	16.66	34.79	5.00	24.65	0.59	0.67	0.13	13.39	32.94	0.4635
	54	N	9286.3[illegible]	18.37	27.09	5.00	32.35	0.46	0.54	0.16	13.89	36.14	0.3497
CID >= 260	151	H	2438.55	28.53	17.38	5.00	41.39	0.30	0.38	0.22	23.70	50.16	0.2061
	151	L	1993.53	27.45	20.90	5.00	37.93	0.36	0.44	0.19	22.67	47.77	0.2627
	151	D	2654.98	14.88	42.07	5.00	17.84	0.70	0.79	0.11	11.63	48.07	0.5670
	151	N	2613.68	14.94	41.32	5.00	18.82	0.69	0.77	0.11	11.65	47.56	0.5514

TABLE 57

SUMMARY OF CONTINGENCY TABLE ANALYSIS-- CO
GROUPED BY CID
FEDERAL SHORT CYCLE - 300 CAR FLEET
FIXED SHORT TEST EFFECTIVENESS; STE= 60%

CID	NO. OF VEHICLES	MODE	CUT POINTS ST UNITS	CUT POINTS FTP UNITS	% CORRECT FAILURES	% EC	% EO	STE	STRR	EC/(EC+FF)	FTP AVG FOR ST PASS	FTP AVG FOR ST FAIL	CORRE-LATION
ALL	300		11.25	19.79	32.29	3.07	21.53	0.60	0.66	0.09	11.50	44.56	0.5563
CID <= 150	95		12.27	16.97	26.82	5.83	17.88	0.60	0.73	0.18	11.43	27.85	0.5244
150 TO 260	54		9.10	18.72	33.32	2.22	22.22	0.60	0.64	0.06	11.19	34.88	0.5711
CID >= 260	151		11.08	21.13	34.29	1.67	22.86	0.60	0.63	0.05	10.83	52.87	0.5786

TABLE 58

SUMMARY OF CONTINGENCY TABLE ANALYSIS-- CO
GROUPED BY CID
FEDERAL 3-MODE - 300 CAR FLEET
FIXED SHORT TEST EFFECTIVENESS; STE= 60%

CID	NO. OF VEHICLES	MODE	CUT POINTS ST UNITS	CUT POINTS FTP UNITS	% CORRECT FAILURES	% EC	% EO	STE	STRR	EC/(EC+FF)	FTP AVG FOR ST PASS	FTP AVG FOR ST FAIL	CORRELATION
ALL	300	H	663.68	20.92	33.03	20.73	22.02	0.60	0.98	0.39	22.42	25.57	0.1386
	300	L	810.79	19.90	33.06	16.83	22.04	0.60	0.91	0.34	19.58	28.26	0.2240
	300	D	5866.68	16.88	33.50	5.92	22.33	0.60	0.71	0.15	12.13	37.52	0.4735
	300	N	4910.83	16.51	33.57	6.93	22.38	0.60	0.72	0.17	12.30	36.99	0.4476
CID <= 150	95	H	1415.73	15.01	26.82	26.62	17.88	0.60	1.20	0.50	15.69	17.55	0.1181
	95	L	1714.87	15.17	26.82	20.61	17.88	0.60	1.06	0.43	13.79	19.49	0.2262
	95	D	8364.51	14.76	26.88	10.84	17.92	0.60	0.84	0.29	11.50	22.66	0.4140
	95	N	6498.07	14.54	26.88	13.17	17.92	0.60	0.89	0.33	12.32	21.54	0.3669
150 TO 260	54	H	306.56	19.56	35.06	25.67	23.38	0.60	1.04	0.42	23.91	20.21	-0.0177
	54	L	539.60	17.68	35.41	17.33	23.61	0.60	0.89	0.33	18.65	24.57	0.1746
	54	D	6606.36	16.43	35.67	5.34	23.78	0.60	0.69	0.13	13.39	32.94	0.4675
	54	N	4590.61	15.69	35.67	8.82	23.78	0.60	0.75	0.20	13.81	33.21	0.3780
CID >= 260	151	H	586.57	24.77	35.26	14.66	23.51	0.60	0.85	0.29	23.38	37.78	0.2406
	151	L	648.95	24.59	35.30	12.25	23.53	0.60	0.81	0.26	21.56	41.50	0.2982
	151	D	4642.10	17.31	35.95	2.88	23.96	0.60	0.65	0.07	11.73	50.02	0.5310
	151	N	4192.26	17.05	36.08	3.17	24.06	0.60	0.65	0.08	11.86	50.43	0.5218

TABLE 59

SUMMARY OF CONTINGENCY TABLE ANALYSIS-- CO -CONTINUED
GROUPED BY CID
FEDERAL SHORT CYCLE - 300 CAR FLEET
FIXED SHORT TEST EFFECTIVENESS; STE= 70%

CID	NO. OF VEHICLES	MODE	CUT POINTS ST UNITS	CUT POINTS FTP UNITS	% CORRECT FAILURES	% EC	% EO	STE	STRR	EC/(EC+FF)	FTP AVG FOR ST PASS	FTP AVG FOR ST FAIL	CORRELATION
ALL	300		8.12	16.42	37.67	5.27	16.15	0.70	0.80	0.12	10.47	38.21	0.5902
CID <= 150	95		9.95	15.60	31.29	9.10	13.41	0.70	0.90	0.23	10.53	24.72	0.5425
150 TO 260	54		6.96	16.74	38.88	4.02	16.66	0.70	0.77	0.09	11.07	33.18	0.6119
CID >= 260	151		7.59	17.08	40.00	3.19	17.14	0.70	0.76	0.07	10.43	48.80	0.6250

TABLE 60

SUMMARY OF CONTINGENCY TABLE ANALYSIS-- CO -CONTINUED
GROUPED BY CID
FEDERAL 3-MODE - 300 CAR FLEET
FIXED SHORT TEST EFFECTIVENESS; STE= 70%

CID	NO. OF VEHICLES	MODE	CUT POINTS ST UNITS	CUT POINTS FTP UNITS	% CORRECT FAILURES	% EC	% EO	STE	STRR	EC/(EC+FF)	FTP AVG FOR ST PASS	FTP AVG FOR ST FAIL	CORRELATION
ALL	300	H	406.39	20.60	38.54	25.57	16.52	0.70	1.16	0.40	22.80	24.78	0.1359
	300	L	503.41	19.34	38.57	21.60	16.53	0.70	1.09	0.36	19.61	27.96	0.2224
	300	D	3475.28	15.00	39.08	9.04	16.75	0.70	0.86	0.19	11.64	35.09	0.4922
	300	N	2885.95	14.73	39.16	10.31	16.78	0.70	0.88	0.21	12.07	34.99	0.4626
CID <= 150	95	H	919.57	14.73	31.29	32.55	13.41	0.70	1.43	0.51	16.67	16.83	0.1151
	95	L	1152.24	14.67	31.29	26.44	13.41	0.70	1.29	0.46	14.75	17.82	0.2232
	95	D	5369.10	13.76	31.36	15.42	13.44	0.70	1.04	0.33	11.44	20.85	0.4192
	95	N	4119.70	13.66	31.36	18.18	13.44	0.70	1.11	0.37	11.29	20.62	0.3687
150 TO 260	54	H	191.64	19.37	40.91	29.74	17.53	0.70	1.21	0.42	26.09	20.04	-0.0170
	54	L	336.57	17.30	41.31	21.75	17.70	0.70	1.07	0.34	18.55	23.73	0.1725
	54	D	4106.67	15.14	41.61	8.22	17.83	0.70	0.84	0.16	12.63	31.51	0.4883
	54	N	2728.05	14.64	41.61	12.47	17.83	0.70	0.91	0.23	13.95	32.19	0.3868
CID >= 260	151	H	360.20	24.31	41.14	19.02	17.63	0.70	1.02	0.32	22.94	34.05	0.2401
	151	L	399.51	24.05	41.18	16.40	17.65	0.70	0.98	0.28	22.88	35.19	0.3004
	151	D	2689.73	14.93	41.94	4.94	17.97	0.70	0.78	0.11	11.63	48.07	0.5664
	151	N	2428.25	14.70	42.10	5.34	18.04	0.70	0.79	0.11	11.65	47.56	0.5550

TABLE 61

SUMMARY OF CONTINGENCY TABLE ANALYSIS-- CO -CONTINUED
GROUPED BY CID
FEDERAL SHORT CYCLE - 300 CAR FLEET
FIXED SHORT TEST EFFECTIVENESS; STE= 80%

CID	NO. OF VEHICLES	MODE	CUT POINTS ST UNITS	CUT POINTS FTP UNITS	% CORRECT FAILURES	% EC	% EO	STE	STRR	EC/(EC+FF)	FTP AVG FOR ST PASS	FTP AVG FOR ST FAIL	CORRE-LATION
ALL	300		5.60	13.69	43.05	8.83	10.76	0.80	0.96	0.17	9.94	34.15	0.6074
CID <= 150	95		7.82	14.34	35.77	14.02	8.94	0.80	1.11	0.28	10.07	22.84	0.5434
150 TO 260	54		5.14	15.05	44.43	7.10	11.11	0.80	0.93	0.14	11.07	33.18	0.6367
CID >= 260	151		4.97	14.03	45.72	5.89	11.43	0.80	0.90	0.11	9.90	42.39	0.6562

TABLE 62

SUMMARY OF CONTINGENCY TABLE ANALYSIS-- CO -CONTINUED
GROUPED BY CID
FEDERAL 3-MODE - 300 CAR FLEET
FIXED SHORT TEST EFFECTIVENESS: STE= 80%

CID	NO. OF VEHICLES	MODE	CUT POINTS		% CORRECT FAILURES	% EC	% EO	STE	STRR	EC/(EC+FF)	FTP AVG FOR ST		CORRE-LATION
			ST UNITS	FTP UNITS							PASS	FAIL	
ALL	300	H	228.93	20.38	44.04	30.94	11.01	0.80	1.36	0.41	24.37	23.94	0.1283
	300	L	288.34	18.95	44.08	27.23	11.02	0.80	1.29	0.38	20.59	25.73	0.2128
	300	D	1897.70	13.75	44.66	13.60	11.17	0.80	1.04	0.23	10.92	32.47	0.4955
	300	N	1558.96	13.57	44.76	15.12	11.19	0.80	1.07	0.25	11.91	32.17	0.4626
CID <= 150	95	H	555.00	14.52	35.77	39.02	8.94	0.80	1.67	0.52	17.18	16.67	0.1079
	95	L	723.80	14.28	35.77	33.33	8.94	0.80	1.55	0.48	12.82	18.13	0.2122
	95	D	3205.88	13.04	35.84	21.66	8.96	0.80	1.28	0.38	11.21	20.19	0.4101
	95	N	2421.95	13.04	35.84	24.75	8.96	0.80	1.35	0.41	11.77	19.22	0.3578
150 TO 260	54	H	110.59	19.24	46.75	33.77	11.69	0.80	1.38	0.42	26.09	20.04	-0.0156
	54	L	193.77	17.04	47.21	26.79	11.80	0.80	1.25	0.36	19.13	22.62	0.1641
	54	D	2371.71	14.25	47.56	12.45	11.89	0.80	1.01	0.21	11.71	30.34	0.4941
	54	N	1488.95	13.93	47.56	17.35	11.89	0.80	1.09	0.27	12.99	26.46	0.3828
CID >= 260	151	H	203.71	23.99	47.01	24.22	11.75	0.80	1.21	0.34	23.10	33.35	0.2311
	151	L	226.77	23.68	47.06	21.60	11.77	0.80	1.17	0.31	22.54	34.87	0.2922
	151	D	1442.91	13.41	47.93	8.27	11.98	0.80	0.94	0.15	10.92	44.29	0.5864
	151	N	1300.40	13.19	48.11	8.79	12.03	0.80	0.95	0.15	11.39	44.30	0.5729

TABLE 63

SUMMARY OF CONTINGENCY TABLE ANALYSIS-- NOX
GROUPED BY CID
FEDERAL SHORT CYCLE - 300 CAR FLEET
FIXED SHORT TEST REJECTION RATIO; STRR= 100%

CID	NO. OF VEHICLES	MODE	CUT POINTS		% CORRECT FAILURES	%	%				FTP AVG FOR ST		CORRE-LATION
			ST UNITS	FTP UNITS		EC	EO	STE	STRR	EC/(EC+FF)	PASS	FAIL	
ALL	300		2.45	2.98	14.24	6.91	6.91	0.67	1.00	0.33	2.05	3.45	0.5957
CID <= 150	95		2.33	2.99	10.06	5.47	5.47	0.65	1.00	0.35	1.86	3.57	0.5829
150 TO 260	54		2.50	2.94	13.57	6.41	6.41	0.68	1.00	0.32	2.16	3.27	0.5993
CID >= 260	151		2.49	3.01	16.25	8.53	8.53	0.66	1.00	0.34	2.18	3.45	0.5426

TABLE 64

SUMMARY OF CONTINGENCY TABLE ANALYSIS-- NOX
GROUPED BY CID
FEDERAL 3-MODE - 300 CAR FLEET
FIXED SHORT TEST REJECTION RATIO; STRR= 100%

CID	NO. OF VEHICLES	MODE	CUT POINTS ST UNITS	CUT POINTS FTP UNITS	% CORRECT FAILURES	% EC	% EO	STE	STRR	EC/(EC+FF)	FTP AVG FOR ST PASS	FTP AVG FOR ST FAIL	CORRE-LATION
ALL	300	H	1803.21	2.74	10.24	10.91	10.91	0.48	1.00	0.52	2.20	3.02	0.3458
	300	L	1136.19	2.65	10.10	11.05	11.05	0.48	1.00	0.52	2.21	3.10	0.3373
	300	D	184.70	2.44	7.51	13.64	13.64	0.36	1.00	0.64	2.32	2.70	0.1821
	300	N	98.30	2.44	6.59	14.56	14.56	0.31	1.00	0.69	2.36	2.59	0.1270
CID <= 150	95	H	2475.10	2.74	7.96	7.58	7.58	0.51	1.00	0.49	1.97	3.13	0.4226
	95	L	1434.93	2.73	6.56	7.66	7.66	0.46	1.00	0.54	1.95	3.04	0.3720
	95	D	144.28	2.28	4.97	10.57	10.57	0.32	1.00	0.68	2.02	2.55	0.1948
	95	N	103.87	2.15	2.33	11.89	11.89	0.16	1.00	0.84	2.11	1.96	0.0255
150 TO 260	54	H	1572.43	2.77	8.15	11.83	11.83	0.41	1.00	0.59	2.26	3.00	0.2599
	54	L	1154.58	2.74	11.36	8.62	8.62	0.57	1.00	0.43	2.16	3.47	0.4607
	54	D	257.44	2.50	6.78	13.20	13.20	0.34	1.00	0.66	2.37	2.61	0.1746
	54	N	126.41	2.44	5.87	14.11	14.11	0.29	1.00	0.71	2.38	2.72	0.1175
CID >= 260	151	H	1589.18	2.88	13.26	11.52	11.52	0.54	1.00	0.46	2.32	3.46	0.3819
	151	L	985.05	2.69	10.83	13.95	13.95	0.44	1.00	0.56	2.41	3.00	0.2518
	151	D	183.40	2.58	8.53	16.25	16.25	0.34	1.00	0.66	2.53	2.75	0.1281
	151	N	85.26	2.68	9.37	15.41	15.41	0.38	1.00	0.62	2.52	2.81	0.1732

TABLE 65

SUMMARY OF CONTINGENCY TABLE ANALYSIS-- NOX
GROUPED BY CID
FEDERAL SHORT CYCLE - 300 CAR FLEET
EC/(EC+FF) = 10% AND 20%; EC/(EC+FF)= 10%

CID	NO. OF VEHICLES	MODE	CUT POINTS ST UNITS	CUT POINTS FTP UNITS	% CORRECT FAILURES	% EC	% EO	STE	STRR	EC/(EC+FF)	FTP AVG FOR ST PASS	FTP AVG FOR ST FAIL	CORRELATION
ALL	300		3.69	4.09	5.64	0.63	15.52	0.27	0.30	0.10	2.32	4.82	0.4357
CID <= 150	95		3.69	4.39	3.54	0.39	11.99	0.23	0.25	0.10	2.08	3.57	0.4162
150 TO 260	54		3.53	3.73	5.74	0.64	14.24	0.29	0.32	0.10	2.38	4.96	0.4569
CID >= 260	151		3.90	4.25	5.08	0.56	19.70	0.20	0.23	0.10	2.48	5.27	0.3694

TABLE 66

SUMMARY OF CONTINGENCY TABLE ANALYSIS-- NOX
GROUPED BY CID
FEDERAL 3-MODE - 300 CAR FLEET
EC/(EC+FF) = 10% AND 20%: EC/(EC+FF)= 10%

CID	NO. OF VEHICLES	MODE	CUT POINTS ST UNITS	CUT POINTS FTP UNITS	% CORRECT FAILURES	% EC	% EQ	STE	STRR	EC/(EC+FF)	FTP AVG FOR ST PASS	FTP AVG FOR ST FAIL	CORRELATION
ALL	300	H		*****	PRACTICAL SOLUTION DOES NOT EXIST				*****				
	300	L		*****	PRACTICAL SOLUTION DOES NOT EXIST				*****				
	300	D		*****	PRACTICAL SOLUTION DOES NOT EXIST				*****				
	300	N		*****	PRACTICAL SOLUTION DOES NOT EXIST				*****				
CID <= 150	95	H		*****	PRACTICAL SOLUTION DOES NOT EXIST				*****				
	95	L		*****	PRACTICAL SOLUTION DOES NOT EXIST				*****				
	95	D		*****	PRACTICAL SOLUTION DOES NOT EXIST				*****				
	95	N		*****	PRACTICAL SOLUTION DOES NOT EXIST				*****				
150 TO 260	54	H		*****	PRACTICAL SOLUTION DOES NOT EXIST				*****				
	54	L	3282.57	4.65	1.30	0.14	18.68	0.06	0.07	0.10	2.43	0.00	0.2117
	54	D		*****	PRACTICAL SOLUTION DOES NOT EXIST				*****				
	54	N		*****	PRACTICAL SOLUTION DOES NOT EXIST				*****				
CID >= 260	151	H		*****	PRACTICAL SOLUTION DOES NOT EXIST				*****				
	151	L		*****	PRACTICAL SOLUTION DOES NOT EXIST				*****				
	151	D		*****	PRACTICAL SOLUTION DOES NOT EXIST				*****				
	151	N		*****	PRACTICAL SOLUTION DOES NOT EXIST				*****				

TABLE 67

SUMMARY OF CONTINGENCY TABLE ANALYSIS-- NOX -CONTINUED
GROUPED BY CID
FEDERAL SHORT CYCLE - 300 CAR FLEET
EC/(EC+FF) = 10% AND 20%: EC/(EC+FF)= 20%

CID	NO. OF VEHICLES	MODE	CUT POINTS ST UNITS	CUT POINTS FTP UNITS	% CORRECT FAILURES	% EC	% EO	STE	STRR	EC/(EC+FF)	FTP AVG FOR ST PASS	FTP AVG FOR ST FAIL	CORRE-LATION
ALL	300		3.00	3.47	9.82	2.45	11.33	0.46	0.58	0.20	2.24	3.79	0.5390
CID <= 150	95		2.97	3.65	6.35	1.59	9.19	0.41	0.51	0.20	2.06	3.18	0.5224
150 TO 260	54		2.96	3.28	9.68	2.42	10.30	0.48	0.61	0.20	2.28	3.44	0.5569
CID >= 260	151		3.15	3.59	9.94	2.48	14.84	0.40	0.50	0.20	2.38	4.26	0.4817

TABLE 68

SUMMARY OF CONTINGENCY TABLE ANALYSIS-- NOX -CONTINUED
GROUPED BY CID
FEDERAL 3-MODE - 300 CAR FLEET
EC/(EC+FF) = 10% AND 20%: EC/(EC+FF)= 20%

CID	NO. OF VEHICLES	MODE	CUT POINTS ST UNITS	CUT POINTS FTP UNITS	% CORRECT FAILURES	% EC	% EO	STE	STRR	EC/(EC+FF)	FTP AVG FOR ST PASS	FTP AVG FOR ST FAIL	CORRELATION
ALL	300	H	4378.55	4.60	0.77	0.19	20.38	0.04	0.05	0.20	2.39	0.00	0.1418
	300	L	4027.00	4.89	0.64	0.16	20.51	0.03	0.04	0.20	2.39	0.00	0.1290
	300	D		***** PRACTICAL SOLUTION DOES NOT EXIST *****									
	300	N		***** PRACTICAL SOLUTION DOES NOT EXIST *****									
CID <= 150	95	H	5027.83	4.47	1.55	0.39	13.99	0.10	0.12	0.20	2.09	0.00	0.2502
	95	L	2202.35	3.54	0.59	0.15	13.63	0.04	0.05	0.20	2.02	3.72	0.1627
	95	D		***** PRACTICAL SOLUTION DOES NOT EXIST *****									
	95	N		***** PRACTICAL SOLUTION DOES NOT EXIST *****									
150 TO 260	54	H		***** PRACTICAL SOLUTION DOES NOT EXIST *****									
	54	L	2217.16	3.69	3.71	0.93	16.27	0.19	0.23	0.20	2.34	3.89	0.3308
	54	D		***** PRACTICAL SOLUTION DOES NOT EXIST *****									
	54	N		***** PRACTICAL SOLUTION DOES NOT EXIST *****									
CID >= 260	151	H	3056.49	4.28	2.18	0.55	22.60	0.09	0.11	0.20	2.55	4.68	0.2142
	151	L		***** PRACTICAL SOLUTION DOES NOT EXIST *****									
	151	D		***** PRACTICAL SOLUTION DOES NOT EXIST *****									
	151	N		***** PRACTICAL SOLUTION DOES NOT EXIST *****									

TABLE 69

SUMMARY OF CONTINGENCY TABLE ANALYSIS-- NOX
GROUPED BY CID
FEDERAL SHORT CYCLE - 300 CAR FLEET
METHOD OF BOUNDED ERRORS OF COMMISSION; EC= 5%

CID	NO. OF VEHICLES	MODE	CUT POINTS ST UNITS	CUT POINTS FTP UNITS	% CORRECT FAILURES	% EC	% EO	STE	STRR	EC/(EC+FF)	FTP AVG FOR ST PASS	FTP AVG FOR ST FAIL	CORRELATION
ALL	300		2.62	3.14	12.77	5.00	8.38	0.60	0.84	0.28	2.12	3.48	0.5772
CID <= 150	95		2.37	3.04	9.76	5.00	5.78	0.63	0.95	0.34	1.86	3.57	0.5811
150 TO 260	54		2.62	3.03	12.52	5.00	7.46	0.63	0.88	0.29	2.21	3.38	0.5935
CID >= 260	151		2.78	3.27	13.29	5.00	11.49	0.54	0.74	0.27	2.28	3.68	0.5246

SUMMARY OF CONTINGENCY TABLE ANALYSIS-- NOX
GROUPED BY CID
FEDERAL 3-MODE - 300 CAR FLEET
METHOD OF BOUNDED ERRORS OF COMMISSION; EC= 5%

CID	NO. OF VEHICLES	MODE	CUT POINTS ST UNITS	CUT POINTS FTP UNITS	% CORRECT FAILURES	% EC	% EO	STE	STRR	EC/(EC+FF)	FTP AVG FOR ST PASS	FTP AVG FOR ST FAIL	CORRELATION
ALL	300	H	2265.12	3.08	6.56	5.00	14.59	0.31	0.55	0.43	2.29	3.48	0.3151
	300	L	1562.55	2.98	6.38	5.00	14.77	0.30	0.54	0.44	2.30	3.34	0.3062
	300	D	292.49	2.54	3.54	5.00	17.61	0.17	0.43	0.59	2.35	2.77	0.1520
	300	N	142.82	2.53	2.76	5.00	18.40	0.13	0.37	0.64	2.38	2.61	0.1021
CID <= 150	95	H	2806.22	2.97	6.50	5.00	9.03	0.42	0.74	0.43	1.99	3.25	0.4081
	95	L	1546.06	2.85	5.23	5.00	8.99	0.37	0.72	0.49	1.97	3.25	0.3568
	95	D	190.62	2.44	2.90	5.00	12.63	0.19	0.51	0.63	2.06	2.56	0.1714
	95	N	119.90	2.18	1.02	5.00	13.19	0.07	0.42	0.83	2.09	2.13	0.0201
150 TO 260	54	H	1984.55	3.10	4.62	5.00	15.36	0.23	0.48	0.52	2.34	3.97	0.2286
	54	L	1395.98	2.95	8.86	5.00	11.12	0.44	0.69	0.36	2.18	3.64	0.4409
	54	D	395.72	2.63	3.26	5.00	16.72	0.16	0.41	0.61	2.41	2.66	0.1462
	54	N	182.23	2.45	2.49	5.00	17.49	0.12	0.38	0.67	2.43	2.35	0.0946
CID >= 260	151	H	1986.04	3.26	8.47	5.00	16.31	0.34	0.54	0.37	2.43	3.62	0.3482
	151	L	1515.60	3.01	5.42	5.00	19.36	0.22	0.42	0.48	2.50	3.27	0.2151
	151	D	328.09	2.66	3.24	5.00	21.54	0.13	0.33	0.61	2.54	2.87	0.1011
	151	N	.126.85	2.92	3.96	5.00	20.82	0.16	0.36	0.56	2.52	3.31	0.1409

TABLE 71

SUMMARY OF CONTINGENCY TABLE ANALYSIS-- NOX
GROUPED BY CID
FEDERAL SHORT CYCLE - 300 CAR FLEET
FIXED SHORT TEST EFFECTIVENESS; STE= 60%

CID	NO. OF VEHICLES	MODE	CUT POINTS ST UNITS	CUT POINTS FTP UNITS	% CORRECT FAILURES	% EC	% EO	STE	STRR	EC/(EC+FF)	FTP AVG FOR ST PASS	FTP AVG FOR ST FAIL	CORRE-LATION
ALL	300		2.63	3.15	12.69	4.91	8.46	0.60	0.83	0.28	2.12	3.49	0.5766
CID <= 150	95		2.44	3.11	9.32	4.38	6.21	0.60	0.88	0.32	1.88	3.61	0.5775
150 TO 260	54		2.68	3.07	11.99	4.40	7.99	0.60	0.82	0.27	2.25	3.44	0.5888
CID >= 260	151		2.62	3.13	14.87	6.69	9.91	0.60	0.87	0.31	2.21	3.50	0.5366

TABLE 72

SUMMARY OF CONTINGENCY TABLE ANALYSIS-- NOX
GROUPED BY CID
FEDERAL 3-MODE - 300 CAR FLEET
FIXED SHORT TEST EFFECTIVENESS: STE= 60%

CID	NO. OF VEHICLES	MODE	CUT POINTS ST UNITS	CUT POINTS FTP UNITS	% CORRECT FAILURES	% EC	% EO	STE	STRR	EC/(EC+FF)	FTP AVG FOR ST PASS	FTP AVG FOR ST FAIL	CORRE-LATION
ALL	300	H	1558.28	2.57	12.69	16.51	8.46	0.60	1.38	0.57	2.15	2.98	0.3509
	300	L	919.13	2.48	12.69	17.07	8.46	0.60	1.41	0.57	2.13	2.92	0.3426
	300	D	113.80	2.37	12.69	29.28	8.46	0.60	1.98	0.70	2.26	2.63	0.1892
	300	N	63.40	2.38	12.69	34.41	8.46	0.60	2.23	0.73	2.28	2.52	0.1338
CID <= 150	95	H	2200.43	2.56	9.32	10.76	6.21	0.60	1.29	0.54	1.88	3.00	0.4274
	95	L	1273.43	2.56	8.53	13.15	5.69	0.60	1.52	0.61	1.93	2.96	0.3786
	95	D	89.66	2.10	9.32	27.60	6.21	0.60	2.38	0.75	1.97	2.31	0.2051
	95	N	63.01	2.09	8.53	47.79	5.69	0.60	3.96	0.85	1.98	2.20	0.0302
150 TO 260	54	H	1255.43	2.51	11.99	22.61	7.99	0.60	1.73	0.65	2.18	2.97	0.2668
	54	L	1099.79	2.69	11.99	9.79	7.99	0.60	1.09	0.45	2.13	3.47	0.4628
	54	D	155.44	2.41	11.99	30.00	7.99	0.60	2.10	0.71	2.35	2.52	0.1824
	54	N	78.42	2.42	11.99	35.53	7.99	0.60	2.38	0.75	2.32	2.56	0.1249
CID >= 260	151	H	1475.86	2.78	14.87	14.55	9.91	0.60	1.19	0.49	2.26	3.39	0.3851
	151	L	740.06	2.55	14.87	23.38	9.91	0.60	1.54	0.61	2.22	3.03	0.2569
	151	D	108.22	2.55	14.87	33.54	9.91	0.60	1.95	0.69	2.49	2.67	0.1331
	151	N	61.50	2.54	14.87	29.68	9.91	0.60	1.80	0.67	2.45	2.73	0.1784

TABLE 73

SUMMARY OF CONTINGENCY TABLE ANALYSIS-- NOX -CONTINUED
GROUPED BY CID
FEDERAL SHORT CYCLE - 300 CAR FLEET
FIXED SHORT TEST EFFECTIVENESS; STE= 70%

CID	NO. OF VEHICLES	MODE	CUT POINTS ST UNITS	CUT POINTS FTP UNITS	% CORRECT FAILURES	% EC	% EO	STE	STRR	EC/(EC+FF)	FTP AVG FOR ST PASS	FTP AVG FOR ST FAIL	CORRE- LATION
ALL	300		2.38	2.92	14.81	7.80	6.35	0.70	1.07	0.35	2.05	3.43	0.5869
CID <= 150	95		2.20	2.86	10.88	6.96	4.66	0.70	1.15	0.39	1.82	3.53	0.5845
150 TO 260	54		2.46	2.90	13.99	7.05	5.99	0.70	1.05	0.34	2.16	3.27	0.6003
CID >= 260	151		2.38	2.92	17.34	10.28	7.43	0.70	1.11	0.37	2.16	3.45	0.5439

TABLE 74

SUMMARY OF CONTINGENCY TABLE ANALYSIS-- NOX -CONTINUED
GROUPED BY CID
FEDERAL 3-MODE - 300 CAR FLEET
FIXED SHORT TEST EFFECTIVENESS; STE= 70%

CID	NO. OF VEHICLES	MODE	CUT POINTS ST UNITS	CUT POINTS FTP UNITS	% CORRECT FAILURES	% EC	% EO	STE	STRR	EC/(EC+FF)	FTP AVG FOR ST PASS	FTP AVG FOR ST FAIL	CORRE-LATION
ALL	300	H	1362.07	2.42	14.81	22.88	6.35	0.70	1.78	0.61	2.04	2.96	0.3454
	300	L	763.93	2.36	14.81	23.55	6.35	0.70	1.81	0.61	2.03	2.87	0.3370
	300	D	92.26	2.35	14.81	37.46	6.35	0.70	2.47	0.72	2.22	2.56	0.1839
	300	N	54.04	2.36	14.81	42.83	6.35	0.70	2.72	0.74	2.16	2.53	0.1296
CID <= 150	95	H	1908.09	2.36	10.88	15.66	4.66	0.70	1.71	0.59	1.77	2.73	0.4222
	95	L	1149.13	2.43	9.95	18.76	4.27	0.70	2.02	0.65	1.91	2.80	0.3715
	95	D	75.00	2.04	10.88	35.99	4.66	0.70	3.02	0.77	1.93	2.28	0.1988
	95	N	54.02	2.07	9.95	56.68	4.27	0.70	4.69	0.85	1.99	2.15	0.0291
150 TO 260	54	H	1107.76	2.39	13.99	30.13	5.99	0.70	2.21	0.68	2.14	2.81	0.2605
	54	L	935.37	2.54	13.99	14.39	5.99	0.70	1.42	0.51	2.07	3.09	0.4613
	54	D	126.64	2.38	13.99	38.31	5.99	0.70	2.62	0.73	2.26	2.57	0.1771
	54	N	66.65	2.42	13.99	44.08	5.99	0.70	2.91	0.76	2.22	2.58	0.1209
CID >= 260	151	H	1307.80	2.62	17.34	20.42	7.43	0.70	1.52	0.54	2.19	3.09	0.3817
	151	L	613.16	2.47	17.34	30.77	7.43	0.70	1.94	0.64	2.20	2.97	0.2514
	151	D	86.98	2.54	17.34	41.59	7.43	0.70	2.38	0.71	2.34	2.72	0.1291
	151	N	52.56	2.49	17.34	37.61	7.43	0.70	2.22	0.68	2.21	2.82	0.1736

TABLE 75

SUMMARY OF CONTINGENCY TABLE ANALYSIS-- NOX -CONTINUED
GROUPED BY CID
FEDERAL SHORT CYCLE - 300 CAR FLEET
FIXED SHORT TEST EFFECTIVENESS; STE= 80%

CID	NO. OF VEHICLES	MODE	CUT POINTS ST UNITS	CUT POINTS FTP UNITS	% CORRECT FAILURES	% EC	% EO	STE	STRR	EC/(EC+FF)	FTP AVG FOR ST PASS	FTP AVG FOR ST FAIL	CORRE-LATION
ALL	300		2.12	2.69	16.92	12.32	4.23	0.80	1.38	0.42	1.98	3.35	0.5779
CID <= 150	95		1.94	2.60	12.43	11.04	3.11	0.80	1.51	0.47	1.74	3.26	0.5721
150 TO 260	54		2.22	2.72	15.98	11.26	4.00	0.80	1.36	0.41	2.10	3.21	0.5921
CID >= 260	151		2.13	2.70	19.82	15.73	4.96	0.80	1.43	0.44	2.09	3.36	0.5330

TABLE 76

SUMMARY OF CONTINGENCY TABLE ANALYSIS-- NOX -CONTINUED
GROUPED BY CID
FEDERAL 3-MODE - 300 CAR FLEET
FIXED SHORT TEST EFFECTIVENESS; STE= 80%

CID	NO. OF VEHICLES	MODE	CUT POINTS ST UNITS	CUT POINTS FTP UNITS	% CORRECT FAILURES	% EC	% EO	STE	STRR	EC/(EC+FF)	FTP AVG FOR ST PASS	FTP AVG FOR ST FAIL	CORRELATION
ALL	300	H	1164.12	2.28	16.92	31.44	4.23	0.80	2.29	0.65	1.97	2.80	0.3279
	300	L	615.61	2.25	16.92	32.23	4.23	0.80	2.32	0.66	1.98	2.79	0.3196
	300	D	72.17	2.33	16.92	47.15	4.23	0.80	3.03	0.74	2.10	2.55	0.1720
	300	N	44.84	2.34	16.92	52.32	4.23	0.80	3.27	0.76	1.95	2.50	0.1207
CID <= 150	95	H	1616.38	2.17	12.43	22.75	3.11	0.80	2.26	0.65	1.72	2.62	0.4025
	95	L	1004.22	2.27	11.37	26.70	2.84	0.80	2.68	0.70	1.78	2.75	0.3516
	95	D	60.87	2.00	12.43	46.27	3.11	0.80	3.78	0.79	1.84	2.27	0.1856
	95	N	43.49	2.05	11.37	65.86	2.84	0.80	5.43	0.85	1.65	2.18	0.0269
150 TO 260	54	H	957.01	2.26	15.98	39.66	4.00	0.80	2.78	0.71	2.03	2.72	0.2450
	54	L	774.95	2.39	15.98	21.10	4.00	0.80	1.86	0.57	2.03	3.01	0.4440
	54	D	99.66	2.36	15.98	48.14	4.00	0.80	3.21	0.75	2.29	2.54	0.1654
	54	N	55.10	2.42	15.98	53.67	4.00	0.80	3.49	0.77	2.21	2.51	0.1125
CID >= 260	151	H	1135.90	2.45	19.82	28.41	4.96	0.80	1.95	0.59	2.11	3.00	0.3649
	151	L	492.12	2.40	19.82	39.93	4.96	0.80	2.41	0.67	2.09	2.93	0.2370
	151	D	67.37	2.53	19.82	50.60	4.96	0.80	2.84	0.72	2.34	2.66	0.1204
	151	N	43.75	2.44	19.82	46.83	4.96	0.80	2.69	0.70	2.02	2.73	0.1625

TABLE 77

SUMMARY OF CONTINGENCY TABLE ANALYSIS-- CMP3
GROUPED BY CID
FEDERAL SHORT CYCLE - 300 CAR FLEET
FIXED SHORT TEST REJECTION RATIO; STRR= 100%

CID	NO. OF VEHICLES	MODE	CUT POINTS ST UNITS	CUT POINTS FTP UNITS	% CORRECT FAILURES	% EC	% EO	STE	STRR	EC/(EC+FF)	FTP AVG FOR ST PASS	FTP AVG FOR ST FAIL	CORRE-LATION
ALL	300				59.67	12.67	5.67	0.91	1.11	0.18			0.5829
CID <= 150	95				47.37	11.58	10.53	0.82	1.02	0.20			0.5452
150 TO 260	54				61.11	7.41	7.41	0.89	1.00	0.11			0.6566
CID >= 260	151				65.56	13.25	3.31	0.95	1.14	0.17			0.5964

TABLE 78

SUMMARY OF CONTINGENCY TABLE ANALYSIS-- CMP3
GROUPED BY CID
FEDERAL 3-MODE - 300 CAR FLEET
FIXED SHORT TEST REJECTION RATIO; STRR= 100%

CID	NO. OF VEHICLES	MODE	CUT POINTS ST UNITS	CUT POINTS FTP UNITS	% CORRECT FAILURES	% EC	% EO	STE	STRR	EC/(EC+FF)	FTP AVG FOR ST PASS	FTP AVG FOR ST FAIL	CORRE-LATION
ALL	300	H			47.33	18.67	18.00	0.72	1.01	0.28			0.1869
	300	L			50.67	18.67	14.67	0.78	1.06	0.27			0.2447
	300	D			54.67	16.33	10.67	0.84	1.09	0.23			0.3834
	300	N			53.00	15.67	12.33	0.81	1.05	0.23			0.3686
		B			49.33	10.33	16.00	0.76	0.91	0.17			0.4434
CID <= 150	95	H			38.95	21.05	18.95	0.67	1.04	0.35			0.1741
	95	L			40.00	25.26	17.89	0.69	1.13	0.39			0.0943
	95	D			45.26	15.79	12.63	0.78	1.05	0.26			0.4119
	95	N			43.16	21.05	14.74	0.75	1.11	0.33			0.2528
		B			44.21	9.47	13.68	0.76	0.93	0.18			0.5333
150 TO 260	54	H			50.00	24.07	18.52	0.73	1.08	0.32			-0.0371
	54	L			55.56	18.52	12.96	0.81	1.08	0.25			0.2359
	54	D			59.26	14.81	9.26	0.86	1.08	0.20			0.4179
	54	N			51.85	11.11	16.67	0.76	0.92	0.18			0.3884
		B			55.56	9.26	12.96	0.81	0.95	0.14			0.5025
CID >= 260	151	H			54.97	15.89	13.91	0.80	1.03	0.22			0.2929
	151	L			56.29	15.89	12.58	0.82	1.05	0.22			0.3169
	151	D			57.62	13.25	11.26	0.84	1.03	0.19			0.4188
	151	N			58.28	12.58	10.60	0.85	1.03	0.18			0.4503
		B			56.95	6.62	11.92	0.83	0.92	0.10			0.5909

TABLE 79

SUMMARY OF CONTINGENCY TABLE ANALYSIS-- CMP3
GROUPED BY CID
FEDERAL SHORT CYCLE - 300 CAR FLEET
EC/(EC+FF) = 10% AND 20%; EC/(EC+FF)= 10%

CID	NO. OF VEHICLES	MODE	CUT POINTS ST UNITS	CUT POINTS FTP UNITS	% CORRECT FAILURES	% EC	% EO	STE	STRR	EC/(EC+FF)	FTP AVG FOR ST PASS	FTP AVG FOR ST FAIL	CORRE-LATION
ALL	300				45.00	2.33	20.33	0.69	0.72	0.05			0.5924
CID <= 150	95				20.00	0.00	37.89	0.35	0.35	0.00			0.4264
150 TO 260	54				44.44	3.70	24.07	0.65	0.70	0.08			0.4936
CID >= 260	151				55.63	4.64	13.25	0.81	0.88	0.08			0.6233

TABLE 80

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                          SUMMARY OF CONTINGENCY TABLE ANALYSIS-- CMP3
                          GROUPED BY        CID
                          FEDERAL 3-MODE - 300 CAR FLEET
                          EC/(EC+FF) = 10%  AND 20%; EC/(EC+FF)=  10%

                 NO.     M                               %        %        %
                 OF      O        CUT POINTS          CORRECT                                                       FTP AVG
     CID       VEHICLES  D   ST UNITS    FTP UNITS    FAILURES    EC       EO       STE     STRR   EC/(EC+FF)   FOR ST        CORRE-
                         E                                                                                      PASS    FAIL   LATION

ALL              300     H               *****  PRACTICAL SOLUTION DOES NOT EXIST *****
                 300     L               *****  PRACTICAL SOLUTION DOES NOT EXIST *****
                 300     D               *****  PRACTICAL SOLUTION DOES NOT EYIST *****
                 300     N               *****  PRACTICAL SOLUTION DOES NOT EXIST *****
                         B               *****         NO MEANINGFUL SOLUTION     *****
CID <= 150        95     H               *****  PRACTICAL SOLUTION DOES NOT EXIST *****
                  95     L               *****  PRACTICAL SOLUTION DOES NOT EXIST *****
                  95     D               *****  PRACTICAL SOLUTION DOES NOT EXIST *****
                  95     N               *****  PRACTICAL SOLUTION DOES NOT EXIST *****
                         B               *****         NO MEANINGFUL SOLUTION     *****
150 TO 260        54     H               *****  PRACTICAL SOLUTION DOES NOT EXIST *****
                  54     L               *****  PRACTICAL SOLUTION DOES NOT EXIST *****
                  54     D               *****  PRACTICAL SOLUTION DOES NOT EXIST *****
                  54     N               *****  PRACTICAL SOLUTION DOES NOT EXIST *****
                         B               *****         NO MEANINGFUL SOLUTION     *****
CID >= 260       151     H               *****  PRACTICAL SOLUTION DOES NOT EXIST *****
                 151     L               *****  PRACTICAL SOLUTION DOES NOT EXIST *****
                 151     D               *****  PRACTICAL SOLUTION DOES NOT EXIST *****
                 151     N               *****  PRACTICAL SOLUTION DOES NOT EXIST *****
                         B               *****         NO MEANINGFUL SOLUTION     *****
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TABLE 81

SUMMARY OF CONTINGENCY TABLE ANALYSIS-- CMP3-CONTINUED
GROUPED BY CID
FEDERAL SHORT CYCLE - 300 CAR FLEET
EC/(EC+FF) = 10% AND 20%: EC/(EC+FF)= 20%

CID	NO. OF VEHICLES	MODE	CUT POINTS ST UNITS	CUT POINTS FTP UNITS	% CORRECT FAILURES	% EC	% EO	STE	STRR	EC/(EC+FF)	FTP AVG FOR ST PASS	FTP AVG FOR ST FAIL	CORRE-LATION
ALL	300				58.67	10.67	6.67	0.90	1.06	0.15			0.6092
CID <= 150	95				43.16	1.05	14.74	0.75	0.76	0.02			0.7162
150 TO 260	54				57.41	9.26	11.11	0.84	0.97	0.14			0.5357
CID >= 260	151				64.90	10.60	3.97	0.94	1.10	0.14			0.6479

TABLE 82

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                   SUMMARY OF CONTINGENCY TABLE ANALYSIS-- CMP3-CONTINUED
                          GROUPED BY        CID
                          FEDERAL 3-MODE - 300 CAR FLEET
                          EC/(EC+FF) = 10%  AND 20%; EC/(EC+FF)=  20%

                  NO.    M                             %
                  OF     O       CUT POINTS         CORRECT      %        %                                          FTP AVG
   CID         VEHICLES  D   ST UNITS   FTP UNITS   FAILURES     EC       EO        STE     STRR   EC/(EC+FF)   FOR ST        CORRE-
                         E                                                                                   PASS    FAIL    LATION

ALL                300   H               *****  PRACTICAL SOLUTION DOES NOT EXIST *****
                   300   L               *****  PRACTICAL SOLUTION DOES NOT EXIST *****
                   300   D               *****  PRACTICAL SOLUTION DOES NOT EXIST *****
                   300   N               *****  PRACTICAL SOLUTION DOES NOT EXIST *****
                         B                         43.67      7.00     21.67      0.67     0.78      0.14                     0.4440
CID <= 150          95   H               *****  PRACTICAL SOLUTION DOES NOT EXIST *****
                    95   L               *****  PRACTICAL SOLUTION DOES NOT EXIST *****
                    95   D               *****  PRACTICAL SOLUTION DOES NOT EXIST *****
                    95   N               *****  PRACTICAL SOLUTION DOES NOT EXIST *****
                         B                         36.84      6.32     21.05      0.64     0.75      0.15                     0.4848
150 TO 260          54   H               *****  PRACTICAL SOLUTION DOES NOT EXIST *****
                    54   L               *****  PRACTICAL SOLUTION DOES NOT EXIST *****
                    54   D               *****  PRACTICAL SOLUTION DOES NOT EXIST *****
                    54   N               *****  PRACTICAL SOLUTION DOES NOT EXIST *****
                         B               *****       NO MEANINGFUL SOLUTION        *****
CID >= 260         151   H               *****  PRACTICAL SOLUTION DOES NOT EXIST *****
                   151   L               *****  PRACTICAL SOLUTION DOES NOT EXIST *****
                   151   D               *****  PRACTICAL SOLUTION DOES NOT EXIST *****
                   151   N               *****  PRACTICAL SOLUTION DOES NOT EXIST *****
                         B                         54.97      7.28     13.91      0.80     0.90      0.12                     0.5387
```

TABLE 83

SUMMARY OF CONTINGENCY TABLE ANALYSIS-- CMP3
GROUPED BY CID
FEDERAL SHORT CYCLE - 300 CAR FLEET
METHOD OF BOUNDED ERRORS OF COMMISSION; EC= 5%

CID	NO. OF VEHICLES	MODE	CUT POINTS ST UNITS	CUT POINTS FTP UNITS	% CORRECT FAILURES	% EC	% EO	STE	STRR	EC/(EC+FF)	FTP AVG FOR ST PASS	FTP AVG FOR ST FAIL	CORRE-LATION
ALL	300				53.67	7.00	11.67	0.82	0.93	0.12			0.6035
CID <= 150	95				44.21	1.05	13.68	0.76	0.78	0.02			0.7327
150 TO 260	54				55.56	5.56	12.96	0.81	0.89	0.09			0.6043
CID >= 260	151				62.25	7.95	6.62	0.90	1.02	0.11			0.6565

TABLE 84

SUMMARY OF CONTINGENCY TABLE ANALYSIS-- CMP3
GROUPED BY CID
FEDERAL 3-MODE - 300 CAR FLEET
METHOD OF BOUNDED ERRORS OF COMMISSION; EC= 5%

CID	NO. OF VEHICLES	MODE	CUT POINTS ST UNITS	CUT POINTS FTP UNITS	% CORRECT FAILURES	% EC	% EO	STE	STRR	EC/(EC+FF)	FTP AVG FOR ST PASS	FTP AVG FOR ST FAIL	CORRE-LATION
ALL	300	H			22.67	3.33	42.67	0.35	0.40	0.13			0.2721
	300	L			28.33	6.33	37.00	0.43	0.53	0.18			0.2510
	300	D			46.00	6.33	19.33	0.70	0.80	0.12			0.4968
	300	N			39.00	4.67	26.33	0.60	0.67	0.11			0.4436
		B			40.33	3.67	25.00	0.62	0.67	0.08			0.4905
CID <= 150	95	H			18.95	6.32	38.95	0.33	0.44	0.25			0.2014
	95	L			21.05	8.42	36.84	0.36	0.51	0.29			0.1772
	95	D			30.53	6.32	27.37	0.53	0.64	0.17			0.3862
	95	N			22.11	5.26	35.79	0.38	0.47	0.19			0.2844
		B			32.63	6.32	25.26	0.56	0.67	0.16			0.4188
150 TO 260	54	H			12.96	1.85	55.56	0.19	0.22	0.13			0.1704
	54	L			33.33	3.70	35.19	0.49	0.54	0.10			0.3547
	54	D			44.44	5.56	24.07	0.65	0.73	0.11			0.4386
	54	N			33.33	3.70	35.19	0.49	0.54	0.10			0.3547
		B			37.04	1.85	31.48	0.54	0.57	0.05			0.4589
CID >= 260	151	H			30.46	1.99	38.41	0.44	0.47	0.06			0.3743
	151	L			35.10	2.65	33.77	0.51	0.55	0.07			0.4055
	151	D			49.67	5.96	19.21	0.72	0.81	0.11			0.4936
	151	N			50.99	5.30	17.88	0.74	0.82	0.09			0.5322
		B			49.67	3.31	19.21	0.72	0.77	0.06			0.5703

TABLE 85

SUMMARY OF CONTINGENCY TABLE ANALYSIS-- CMP3
GROUPED BY CID
FEDERAL SHORT CYCLE - 300 CAR FLEET
FIXED SHORT TEST EFFECTIVENESS: STE= 60%

CID	NO. OF VEHICLES	MODE	CUT POINTS ST UNITS	CUT POINTS FTP UNITS	% CORRECT FAILURES	% EC	% EO	STE	STRR	EC/(EC+FF)	FTP AVG FOR ST PASS	FTP AVG FOR ST FAIL	CORRE-LATION
ALL	300				49.67	4.00	15.67	0.76	0.82	0.07			0.6154
CID <= 150	95				45.26	1.05	12.63	0.78	0.80	0.02			0.7494
150 TO 260	54				53.70	3.70	14.81	0.78	0.84	0.06			0.6257
CID >= 260	151				57.62	5.96	11.26	0.84	0.92	0.09			0.6206

TABLE 86

SUMMARY OF CONTINGENCY TABLE ANALYSIS-- CMP3
GROUPED BY CID
FEDERAL 3-MODE - 300 CAR FLEET
FIXED SHORT TEST EFFECTIVENESS: STE= 60%

CID	NO. OF VEHICLES	MODE	CUT POINTS ST UNITS	CUT POINTS FTP UNITS	% CORRECT FAILURES	% EC	% EO	STE	STRR	EC/(EC+FF)	FTP AVG FOR ST PASS	FTP AVG FOR ST FAIL	CORRELATION
ALL	300	H			51.00	21.67	14.33	0.78	1.11	0.30			0.1662
	300	L			53.67	21.33	11.67	0.82	1.15	0.28			0.2265
	300	D			54.00	19.00	11.33	0.83	1.12	0.26			0.2985
	300	N			56.00	24.00	9.33	0.86	1.22	0.30			0.1961
		B			41.33	9.33	24.00	0.63	0.78	0.18			0.3459
CID <= 150	95	H			45.26	30.53	12.63	0.78	1.31	0.40			0.0655
	95	L			45.26	25.26	12.63	0.78	1.22	0.36			0.1969
	95	D			45.26	24.21	12.63	0.78	1.20	0.35			0.2217
	95	N			51.58	34.74	6.32	0.89	1.49	0.40			0.0947
		B			40.00	16.84	17.89	0.69	0.98	0.30			0.2900
150 TO 260	54	H			55.56	24.07	12.96	0.81	1.16	0.30			0.0532
	54	L			55.56	16.67	12.96	0.81	1.05	0.23			0.2918
	54	D			57.41	20.37	11.11	0.84	1.14	0.26			0.2131
	54	N			59.26	16.67	9.26	0.86	1.11	0.22			0.3644
		B			42.59	11.11	25.93	0.62	0.78	0.21			0.2503
CID >= 260	151	H			53.64	13.25	15.23	0.78	0.97	0.20			0.3476
	151	L			57.62	16.56	11.26	0.84	1.08	0.22			0.3222
	151	D			60.26	18.54	8.61	0.88	1.14	0.24			0.3164
	151	N			58.28	19.21	10.60	0.85	1.13	0.25			0.2540
		B			43.71	1.32	25.17	0.63	0.65	0.03			0.5510

TABLE 87

SUMMARY OF CONTINGENCY TABLE ANALYSIS-- CMP3-CONTINUED
GROUPED BY CID
FEDERAL SHORT CYCLE - 300 CAR FLEET
FIXED SHORT TEST EFFECTIVENESS; STE= 70%

CID	NO. OF VEHICLES	MODE	CUT POINTS ST UNITS	CUT POINTS FTP UNITS	% CORRECT FAILURES	% EC	% EO	STE	STRR	EC/(EC+FF)	FTP AVG FOR ST PASS	FTP AVG FOR ST FAIL	CORRE-LATION
ALL	300				57.00	9.00	8.33	0.87	1.01	0.14			0.6157
CID <= 150	95				47.37	11.58	10.53	0.82	1.02	0.20			0.5452
150 TO 260	54				59.26	11.11	9.26	0.86	1.03	0.16			0.5207
CID >= 260	151				60.93	8.61	7.95	0.88	1.01	0.12			0.6117

TABLE 88

SUMMARY OF CONTINGENCY TABLE ANALYSIS-- CMP3-CONTINUED
GROUPED BY CID
FEDERAL 3-MODE - 300 CAR FLEET
FIXED SHORT TEST EFFECTIVENESS; STE= 70%

CID	NO. OF VEHICLES	MODE	CUT POINTS		% CORRECT FAILURES	% EC	% ED	STE	STRR	EC/(EC+FF)	FTP AVG FOR ST		CORRE-LATION
			ST UNITS	FTP UNITS							PASS	FAIL	
ALL	300	H			55.67	25.33	9.67	0.85	1.24	0.31			0.1471
	300	L			56.33	23.33	9.00	0.86	1.22	0.29			0.2237
	300	D			59.00	26.00	6.33	0.90	1.30	0.31			0.2040
	300	N			59.33	28.33	6.00	0.91	1.34	0.32			0.1315
		B			49.33	11.33	16.00	0.76	0.93	0.19			0.4172
CID <= 150	95	H			52.63	34.74	5.26	0.91	1.51	0.40			0.1250
	95	L			47.37	32.63	10.53	0.82	1.38	0.41			0.0533
	95	D			49.47	31.58	8.42	0.85	1.40	0.39			0.1317
	95	N			52.63	38.95	5.26	0.91	1.58	0.43			-0.0283
		B			46.32	25.26	11.58	0.80	1.24	0.35			0.2189
150 TO 260	54	H			59.26	29.63	9.26	0.86	1.30	0.33			-0.1128
	54	L			61.11	24.07	7.41	0.89	1.24	0.28			0.1663
	54	D			64.81	24.07	3.70	0.95	1.30	0.27			0.2678
	54	N			61.11	22.22	7.41	0.89	1.22	0.27			0.2318
		B			46.30	11.11	22.22	0.68	0.84	0.19			0.3031
CID >= 260	151	H			59.60	21.85	9.27	0.87	1.18	0.27			0.1945
	151	L			61.59	19.87	7.28	0.89	1.18	0.24			0.3049
	151	D			63.58	24.50	5.30	0.92	1.28	0.28			0.1941
	151	N			62.91	22.52	5.96	0.91	1.24	0.26			0.2494
		B			49.67	4.64	19.21	0.72	0.79	0.09			0.5319

TABLE 89

SUMMARY OF CONTINGENCY TABLE ANALYSIS-- CMP3-CONTINUED
GROUPED BY CID
FEDERAL SHORT CYCLE - 300 CAR FLEET
FIXED SHORT TEST EFFECTIVENESS; STE= 80%

CID	NO. OF VEHICLES	MODE	CUT POINTS ST UNITS	CUT POINTS FTP UNITS	% CORRECT FAILURES	% EC	% EO	STE	STRR	EC/(EC+FF)	FTP AVG FOR ST PASS	FTP AVG FOR ST FAIL	CORRELATION
ALL	300				60.33	14.33	5.00	0.92	1.14	0.19			0.5581
CID <= 150	95				51.58	16 84	6.32	0.89	1.18	0.25			0.5214
150 TO 260	54				59.26	12.96	9.26	0.86	1.05	0.18			0.4698
CID >= 260	151				64.90	13.25	3.97	0.94	1.13	0.17			0.5790

TABLE 90

SUMMARY OF CONTINGENCY TABLE ANALYSIS-- CMP3-CONTINUED
GROUPED BY CID
FEDERAL 3-MODE - 300 CAR FLEET
FIXED SHORT TEST EFFECTIVENESS; STE= 80%

CID	NO. OF VEHICLES	MODE	CUT POINTS ST UNITS	CUT POINTS FTP UNITS	% CORRECT FAILURES	% EC	% EO	STE	STRR	EC/(EC+FF)	FTP AVG FOR ST PASS	FTP AVG FOR ST FAIL	CORRELATION
ALL	300	H			60.00	29.67	5.33	0.92	1.37	0.33			0.0979
	300	L			61.67	27.67	3.67	0.94	1.37	0.31			0.2248
	300	D			62.33	29.33	3.00	0.95	1.40	0.32			0.1858
	300	N			62.67	32.00	2.67	0.96	1.45	0.34			0.0765
		B			57.67	18.00	7.67	0.88	1.16	0.24			0.4031
CID <= 150	95	H			54.74	34.74	3.16	0.95	1.55	0.39			0.1938
	95	L			51.58	35.79	6.32	0.89	1.51	0.41			0.0608
	95	D			52.63	36.84	5.26	0.91	1.55	0.41			0.0548
	95	N			53.68	40.00	4.21	0.93	1.62	0.43			-0.0461
		B			49.47	32.63	8.42	0.85	1.42	0.40			0.1025
150 TO 260	54	H			62.96	31.48	5.56	0.92	1.38	0.33			-0.1644
	54	L			64.81	27.78	3.70	0.95	1.35	0.30			0.1128
	54	D			66.67	25.93	1.85	0.97	1.35	0.28			0.2650
	54	N			66.67	29.63	1.85	0.97	1.41	0.31			0.0782
		B			57.41	12.96	11.11	0.84	1.03	0.18			0.4334
CID >= 260	151	H			64.24	23.18	4.64	0.93	1.27	0.27			0.2625
	151	L			64.90	21.85	3.97	0.94	1.26	0.25			0.3281
	151	D			66.23	26.49	2.65	0.96	1.35	0.29			0.1968
	151	N			66.23	27.15	2.65	0.96	1.36	0.29			0.1661
		B			60.26	9.27	8.61	0.88	1.01	0.13			0.5806

TABLE 91
FEDERAL SHORT CYCLE
CUT-POINTS FOR THE 300 CAR FLEET

ST Cut-Point Selection Technique	ST Cut-Point in Grams/Mile		
	HC	CO	NOx
STRR = 1.0	1.04	5.17	2.45
EC/(EC+FF) = 10%	2.06	9.91	3.69
= 20%	1.37	4.51	3.00
EC = 5%	1.32	8.4	2.62
STE = 0.60	1.29	11.25	2.63
= 0.70	1.07	8.12	2.38
= 0.80	.86	5.60	2.12

TABLE 92
FEDERAL THREE-MODE
CUT-POINTS FOR 300 CAR FLEET

ST Cut-Point Selection Technique	ST Cut-Points in PPM		
	HC Idle in Dr.	CO Idle in Dr.	NOx High Speed
STRR = 1.0	112	2198	1803
EC/(EC+FF) = 10%	573	12945	--
= 20%	298	2956	4379
EC = 5%	183	7081	2265
STE = 0.60	112	5867	1558
= 0.70	89	3475	1362
= 0.80	68	1898	1164

TABLE 93
FEDERAL SHORT CYCLE
TECHNIQUE RANKS FOR THE 300 CAR FLEET

ST Cut-Point Selection Technique	Technique Ranks		
	HC	CO	NOx
STRR = 1.0	6	6	5
EC/(EC+FF) = 10%	1	2	1
= 20%	2	7	2
EC = 5%	3	3	4
STE = 0.60	4	1	3
= 0.70	5	4	6
= 0.80	7	5	7

TABLE 94

FEDERAL THREE-MODE
TECHNIQUE RANKS FOR THE 300 CAR FLEET

ST Cut-Point Selection Technique	Technique Ranks		
	HC Idle in Dr.	CO Idle in Dr.	NOx High Speed
STRR = 1.0	4	6	4
EC/(EC+FF) = 10%	1	1	-
= 20%	2	5	2
EC = 5%	3	2	3
STE = 0.60	4	3	5
= 0.70	6	4	6
= 0.80	7	7	7

TABLE 95

SUMMARY OF CONTINGENCY TABLE ANALYSIS-- HC
GROUPED BY CID
FEDERAL SHORT CYCLE - 117 CAR FLEET (DENVER)
FIXED SHORT TEST REJECTION RATIO; STRR= 100%

CID	NO. OF VEHICLES	MODE	CUT POINTS ST UNITS	CUT POINTS FTP UNITS	% CORRECT FAILURES	% EC	% EO	STE	STRR	EC/(EC+FF)	FTP AVG FOR ST PASS	FTP AVG FOR ST FAIL	CORRE-LATION
ALL	117		0.86	1.66	59.35	8.70	8.70	0.87	1.00	0.13	1.25	2.74	0.5996
CID <= 150	33		0.76	1.86	65.69	7.53	7.53	0.90	1.00	0.10	1.12	2.54	0.6158
150 TO 260	18		0.79	1.67	40.62	13.43	13.43	0.75	1.00	0.25	1.25	2.26	0.4594
CID >= 260	66		0.94	1.54	61.95	7.53	7.53	0.89	1.00	0.11	1.29	2.97	0.6447

TABLE 96

SUMMARY OF CONTINGENCY TABLE ANALYSIS-- HC
GROUPED BY CID
FEDERAL THREE-MODE - 117 CAR FLEET (DENVER)
FIXED SHORT TEST REJECTION RATIO: STRR= 100%

CID	NO. OF VEHICLES	MODE	CUT POINTS ST UNITS	CUT POINTS FTP UNITS	% CORRECT FAILURES	% EC	% EO	STE	STRR	EC/(EC+FF)	FTP AVG FOR ST PASS	FTP AVG FOR ST FAIL	CORRE-LATION
ALL	117	H	45.04	1.78	53.78	14.40	14.40	0.79	1.00	0.21	1.67	2.61	0.3365
	117	L	52.58	1.78	55.14	13.04	13.04	0.81	1.00	0.19	1.40	2.81	0.3991
	117	D	74.67	2.09	53.97	14.20	14.20	0.79	1.00	0.21	1.53	2.70	0.3454
	117	N	63.24	2.09	54.90	13.28	13.28	0.81	1.00	0.19	1.47	2.79	0.3880
CID <= 150	33	H	48.43	2.08	61.08	15.77	15.77	0.79	1.00	0.21	1.93	2.37	0.1136
	33	L	65.94	1.95	63.14	13.71	13.71	0.82	1.00	0.18	1.54	2.50	0.2295
	33	D	62.06	2.16	58.42	15.36	15.36	0.79	1.00	0.21	1.78	2.38	0.2058
	33	N	49.66	2.16	59.06	14.72	14.72	0.80	1.00	0.20	1.70	2.47	0.2390
150 TO 260	18	H	57.58	1.74	44.00	19.70	19.70	0.69	1.00	0.31	1.67	1.95	0.1480
	18	L	60.56	1.60	41.95	12.10	12.10	0.78	1.00	0.22	1.31	2.43	0.5130
	18	D	103.14	1.82	35.69	18.35	18.35	0.66	1.00	0.34	1.50	2.06	0.2611
	18	N	97.49	1.81	35.77	18.27	18.27	0.66	1.00	0.34	1.26	2.16	0.2643
CID >= 260	66	H	46.30	1.71	57.85	11.64	11.64	0.83	1.00	0.17	1.58	2.92	0.4512
	66	L	50.29	1.78	57.50	11.99	11.99	0.83	1.00	0.17	1.44	3.12	0.4345
	66	D	73.01	1.64	58.57	10.91	10.91	0.84	1.00	0.16	1.52	3.06	0.4853
	66	N	61.77	1.69	59.98	9.50	9.50	0.86	1.00	0.14	1.45	3.16	0.5518

TABLE 97

SUMMARY OF CONTINGENCY TABLE ANALYSIS-- HC
GROUPED BY CID
FEDERAL SHORT CYCLE - 117 CAR FLEET (DENVER)
EC/(EC+FF) = 10% AND 20%; EC/(EC+FF)= 10%

CID	NO. OF VEHICLES	MODE	CUT POINTS ST UNITS	CUT POINTS FTP UNITS	% CORRECT FAILURES	% EC	% EO	STE	STRR	EC/(EC+FF)	FTP AVG FOR ST PASS	FTP AVG FOR ST FAIL	CORRE-LATION
ALL	117		0.98	1.76	55.40	6.16	12.66	0.81	0.90	0.10	1.26	2.81	0.5955
[illegible] <= 150	33		0.77	1.87	65.31	7.26	7.91	0.89	0.99	0.10	1.12	2.54	0.6162
150 TO 260	18		1.78	2.02	17.79	1.98	36.25	0.33	0.37	0.10	1.71	2.33	0.3581
CID >= 260	66		0.98	1.58	60.93	6.77	8.55	0.88	0.97	0.10	1.29	2.97	0.6450

TABLE 98

SUMMARY OF CONTINGENCY TABLE ANALYSIS-- HC
GROUPED BY CID
FEDERAL THREE-MODE - 117 CAR FLEET (DENVER)
EC/(EC+FF) = 10% AND 20%; EC/(EC+FF)= 10%

CID	NO. OF VEHICLES	MODE	CUT POINTS ST UNITS	CUT POINTS FTP UNITS	% CORRECT FAILURES	% EC	% EO	STE	STRR	EC/(EC+FF)	FTP AVG FOR ST PASS	FTP AVG FOR ST FAIL	CORRELATION
ALL	117	H	117.65	2.64	22.27	2.47	45.90	0.33	0.36	0.10	1.96	3.04	0.2687
	117	L	102.41	2.30	32.49	3.61	35.68	0.48	0.53	0.10	1.71	2.95	0.3522
	117	D	237.59	2.31	23.79	2.64	44.39	0.35	0.39	0.10	1.84	3.24	0.2808
	117	N	165.02	2.23	30.76	3.42	37.42	0.45	0.50	0.10	1.71	3.23	0.3376
CID <= 150	33	H	225.72	2.69	1.28	0.14	75.57	0.02	0.02	0.10	2.24	0.00	0.0374
	33	L	149.33	2.46	25.33	2.81	51.52	0.33	0.37	0.10	2.05	2.92	0.1951
	33	D	570.16	2.35	10.70	1.19	63.09	0.14	0.16	0.10	2.20	2.58	0.1354
	33	N	330.64	2.27	17.49	1.94	56.29	0.24	0.26	0.10	2.20	2.58	0.1811
150 TO 260	18	H		***** PRACTICAL SOLUTION DOES NOT EXIST *****									
	18	L	115.11	1.92	24.21	2.69	29.83	0.45	0.50	0.10	1.56	2.30	0.4378
	18	D		***** PRACTICAL SOLUTION DOES NOT EXIST *****									
	18	N		***** PRACTICAL SOLUTION DOES NOT EXIST *****									
CID >= 260	66	H	71.03	2.15	42.87	4.76	26.61	0.62	0.69	0.10	1.55	3.22	0.4249
	66	L	80.55	2.22	40.64	4.52	28.84	0.58	0.65	0.10	1.63	3.40	0.4043
	66	D	111.12	1.93	47.07	5.23	22.42	0.68	0.75	0.10	1.51	3.35	0.4664
	66	N	79.86	1.82	53.90	5.99	15.58	0.78	0.86	0.10	1.48	3.23	0.5444

TABLE 99

SUMMARY OF CONTINGENCY TABLE ANALYSIS-- HC -CONTINUED
GROUPED BY CID
FEDERAL SHORT CYCLE - 117 CAR FLEET (DENVER)
EC/(EC+FF) = 10% AND 20%; EC/(EC+FF)= 20%

CID	, NO. OF VEHICLES	MODE	CUT POINTS ST UNITS	CUT POINTS FTP UNITS	% CORRECT FAILURES	% EC	% EO	STE	STRR	EC/(EC+FF)	FTP AVG FOR ST PASS	FTP AVG FOR ST FAIL	CORRE-LATION
ALL	117		0.61	1.46	65.42	16.36	2.63	0.96	1.20	0.20	1.08	2.57	0.5426
CID <= 150	33		0.45	1.73	72.47	18.12	0.76	0.99	1.24	0.20	0.95	2.41	0.4745
150 TO 260	18		1.01	1.75	34.23	8.56	19.82	0.63	0.79	0.20	1.27	2.49	0.4504
CID >= 260	66		0.63	1.21	68.17	17.04	1.31	0.98	1.23	0.20	1.03	2.68	0.5481

TABLE 100

SUMMARY OF CONTINGENCY TABLE ANALYSIS-- HC -CONTINUED
GROUPED BY CID
FEDERAL THREE-MODE - 117 CAR FLEET (DENVER)
EC/(EC+FF) = 10% AND 20%: EC/(EC+FF)= 20%

CID	NO. OF VEHICLES	MODE	CUT POINTS ST UNITS	CUT POINTS FTP UNITS	% CORRECT FAILURES	% EC	% EO	STE	STRR	EC/(EC+FF)	FTP AVG FOR ST PASS	FTP AVG FOR ST FAIL	CORRE-LATION
ALL	117	H	49.54	1.84	51.19	12.80	16.99	0.75	0.94	0.20	1.67	2.61	0.3384
	117	L	49.38	1.75	56.73	14.18	11.44	0.83	1.04	0.20	1.36	2.72	0.3964
	117	D	81.52	2.10	52.11	13.03	16.07	0.76	0.96	0.20	1.55	2.77	0.3470
	117	N	60.04	2.09	55.88	13.97	12.29	0.82	1.02	0.20	1.47	2.79	0.3865
CID <= 150	33	H	59.23	2.12	56.87	14.22	19.98	0.74	0.92	0.20	1.78	2.49	0.1171
	33	L	37.27	1.77	70.56	17.64	6.29	0.92	1.15	0.20	1.94	2.28	0.2042
	33	D	74.50	2.16	54.95	13.74	18.84	0.74	0.93	0.20	1.78	2.38	0.2093
	33	N	49.14	2.16	59.24	14.81	14.54	0.80	1.00	0.20	1.70	2.47	0.2388
150 TO 260	18	H	164.56	2.14	4.87	1.22	58.84	0.08	0.10	0.20	1.77	2.48	0.0863
	18	L	67.76	1.65	39.24	9.81	14.81	0.73	0.91	0.20	1.31	2.43	0.5110
	18	D	523.30	1.80	8.80	2.20	45.24	0.16	0.20	0.20	1.75	2.31	0.1831
	18	N	440.35	1.81	9.22	2.31	44.82	0.17	0.21	0.20	1.75	2.31	0.1880
CID >= 260	66	H	37.73	1.56	62.63	15.66	6.85	0.90	1.13	0.20	1.29	2.71	0.4336
	66	L	42.12	1.66	61.80	15.45	7.69	0.89	1.11	0.20	1.36	2.90	0.4207
	66	D	53.40	1.49	64.11	16.03	5.38	0.92	1.15	0.20	1.42	2.78	0.4585
	66	N	40.01	1.53	66.28	16.57	3.21	0.95	1.19	0.20	1.26	2.78	0.5017

TABLE 101

SUMMARY OF CONTINGENCY TABLE ANALYSIS-- HC
GROUPED BY CID
FEDERAL SHORT CYCLE - 117 CAR FLEET (DENVER)
METHOD OF BOUNDED ERRORS OF COMMISSION; EC= 5%

CID	NO. OF VEHICLES	MODE	CUT POINTS ST UNITS	CUT POINTS FTP UNITS	% CORRECT FAILURES	% EC	% EO	STE	STRR	EC/(EC+FF)	FTP AVG FOR ST PASS	FTP AVG FOR ST FAIL	CORRE-LATION
ALL	117		1.06	1.82	52.96	5.00	15.10	0.78	0.85	0.09	1.29	2.82	0.5871
CID <= 150	33		0.89	1.92	61.34	5.00	11.88	0.84	0.91	0.08	1.22	2.56	0.6100
150 TO 260	18		1.28	1.84	27.29	5.00	26.75	0.50	0.60	0.15	1.45	2.38	0.4223
CID >= 260	66		1.07	1.68	57.91	5.00	11.58	0.83	0.91	0.08	1.33	3.02	0.6383

TABLE 102

SUMMARY OF CONTINGENCY TABLE ANALYSIS-- HC
GROUPED BY CID
FEDERAL THREE-MODE - 117 CAR FLEET (DENVER)
METHOD OF BOUNDED ERRORS OF COMMISSION; EC= 5%

CID	NO. OF VEHICLES	MODE	CUT POINTS ST UNITS	CUT POINTS FTP UNITS	% CORRECT FAILURES	% EC	% EO	STE	STRR	EC/(EC+FF)	FTP AVG FOR ST PASS	FTP AVG FOR ST FAIL	CORRELATION
ALL	117	H	86.78	2.27	32.59	5.00	35.58	0.48	0.55	0.13	1.83	2.85	0.3086
	117	L	89.33	2.17	37.63	5.00	30.55	0.55	0.63	0.12	1.59	2.94	0.3719
	117	D	167.58	2.22	33.30	5.00	34.87	0.49	0.56	0.13	1.72	2.96	0.3175
	117	N	132.89	2.19	36.72	5.00	31.45	0.54	0.61	0.12	1.73	3.01	0.3605
CID <= 150	33	H	123.35	2.34	25.77	5.00	51.08	0.34	0.40	0.16	2.15	2.40	0.1091
	33	L	126.66	2.32	36.23	5.00	40.62	0.47	0.54	0.12	1.90	2.63	0.2189
	33	D	221.02	2.22	29.30	5.00	44.48	0.40	0.46	0.15	2.07	2.49	0.1913
	33	N	168.41	2.20	32.12	5.00	41.66	0.44	0.50	0.13	2.04	2.58	0.2227
150 TO 260	18	H	123.70	1.98	15.54	5.00	48.17	0.24	0.32	0.24	1.84	1.64	0.1263
	18	L	91.68	1.79	30.88	5.00	23.16	0.57	0.66	0.14	1.41	2.44	0.4807
	18	D	322.89	1.81	15.61	5.00	38.43	0.29	0.38	0.24	1.75	2.31	0.2219
	18	N	281.85	1.81	15.78	5.00	38.26	0.29	0.38	0.24	1.75	2.31	0.2250
CID >= 260	66	H	69.69	2.12	43.65	5.00	25.84	0.63	0.70	0.10	1.55	3.22	0.4277
	66	L	77.38	2.17	42.30	5.00	27.19	0.61	0.68	0.11	1.63	3.34	0.4103
	66	D	113.53	1.95	46.38	5.00	23.11	0.67	0.74	0.10	1.51	3.35	0.4639
	66	N	87.08	1.87	51.48	5.00	18.00	0.74	0.81	0.09	1.48	3.27	0.5360

TABLE 103

SUMMARY OF CONTINGENCY TABLE ANALYSIS-- HC
GROUPED BY CID
FEDERAL SHORT CYCLE - 117 CAR FLEET (DENVER)
FIXED SHORT TEST EFFECTIVENESS; STE= 60%

CID	NO. OF VEHICLES	MODE	CUT POINTS ST UNITS	CUT POINTS FTP UNITS	% CORRECT FAILURES	% EC	% EO	STE	STRR	EC/(EC+FF)	FTP AVG FOR ST PASS	FTP AVG FOR ST FAIL	CORRELATION
ALL	117		1.43	2.11	40.84	1.72	27.22	0.60	0.63	0.04	1.49	3.17	0.5150
CID <= 150	33		1.35	2.12	43.94	1.00	29.29	0.60	0.61	0.02	1.52	2.91	0.5008
150 TO 260	18		1.07	1.77	32.43	7.49	21.62	0.60	0.74	0.19	1.27	2.49	0.4447
CID >= 260	66		1.57	2.21	41.69	0.98	27.79	0.60	0.61	0.02	1.49	3.64	0.5287

TABLE 104

SUMMARY OF CONTINGENCY TABLE ANALYSIS-- HC
GROUPED BY CID
FEDERAL THREE-MODE - 117 CAR FLEET (DENVER)
FIXED SHORT TEST EFFECTIVENESS; STE= 60%

CID	NO. OF VEHICLES	MODE	CUT POINTS ST UNITS	CUT POINTS FTP UNITS	% CORRECT FAILURES	% EC	% EO	STE	STRR	EC/(EC+FF)	FTP AVG FOR ST PASS	FTP AVG FOR ST FAIL	CORRE-LATION
ALL	117	H	68.47	[illegible].06	40.90	7.85	27.27	0.60	0.72	0.16	1.64	2.83	0.3293
	117	L	81.77	2.09	40.90	6.06	27.27	0.60	0.69	0.13	1.57	2.93	0.3822
	117	D	127.60	2.16	40.90	7.58	27.27	0.60	0.71	0.16	1.68	2.88	0.3371
	117	N	114.02	2.16	40.90	6.37	27.27	0.60	0.69	0.13	1.69	2.95	0.3731
CID <= 150	33	H	82.62	2.20	46.11	10.63	30.74	0.60	0.74	0.19	1.98	2.48	0.1198
	33	L	106.75	2.20	46.11	7.54	30.74	0.60	0.70	0.14	1.73	2.56	0.2319
	33	D	120.21	2.18	44.27	9.51	29.51	0.60	0.73	0.18	2.02	2.42	0.2093
	33	N	101.53	2.18	44.27	8.57	29.51	0.60	0.72	0.16	1.87	2.58	0.2405
150 TO 260	18	H	71.14	1.79	38.22	16.15	25.48	0.60	0.85	0.30	1.67	1.95	0.1496
	18	L	86.94	1.76	32.43	5.70	21.62	0.60	0.71	0.15	1.41	2.44	0.4885
	18	D	129.50	1.82	32.43	15.57	21.62	0.60	0.89	0.32	1.67	1.96	0.2606
	18	N	116.75	1.81	32.43	15.42	21.62	0.60	0.89	0.32	1.67	1.96	0.2638
CID >= 260	66	H	73.11	2.18	41.69	4.42	27.79	0.60	0.66	0.10	1.55	3.22	0.4204
	66	L	78.53	2.19	41.69	4.82	27.79	0.60	0.67	0.10	1.63	3.34	0.4081
	66	D	130.66	2.08	41.69	3.65	27.79	0.60	0.65	0.08	1.51	3.35	0.4443
	66	N	118.79	2.10	41.69	2.34	27.79	0.60	0.63	0.05	1.51	3.48	0.4854

TABLE 105

SUMMARY OF CONTINGENCY TABLE ANALYSIS-- HC -CONTINUED
GROUPED BY CID
FEDERAL SHORT CYCLE - 117 CAR FLEET (DENVER)
FIXED SHORT TEST EFFECTIVENESS: STE= 70%

CID	NO. OF VEHICLES	MODE	CUT POINTS ST UNITS	CUT POINTS FTP UNITS	% CORRECT FAILURES	% EC	% ED	STE	STRR	EC/(EC+FF)	FTP AVG FOR ST PASS	FTP AVG FOR ST FAIL	CORRE-LATION
ALL	117		1.22	1.94	47.64	3.17	20.42	0.70	0.75	0.06	1.41	2.96	0.5601
CID <= 150	33		1.15	2.03	51.26	2.02	21.97	0.70	0.73	0.04	1.26	2.60	0.5544
150 TO 260	18		0.89	1.70	37.83	11.06	16.21	0.70	0.90	0.23	1.27	2.49	0.4579
CID >= 260	66		1.35	1.98	48.64	2.02	20.85	0.70	0.73	0.04	1.42	3.33	0.5836

TABLE 106

SUMMARY OF CONTINGENCY TABLE ANALYSIS-- HC -CONTINUED
GROUPED BY CID
FEDERAL THREE-MODE - 117 CAR FLEET (DENVER)
FIXED SHORT TEST EFFECTIVENESS: STE= 70%

CID	NO. OF VEHICLES	MODE	CUT POINTS ST UNITS	CUT POINTS FTP UNITS	% CORRECT FAILURES	% EC	% EO	STE	STRR	EC/(EC+FF)	FTP AVG FOR ST PASS	FTP AVG FOR ST FAIL	CORRE-LATION
ALL	117	H	55.66	1.91	47.72	10.91	20.45	0.70	0.86	0.19	1.64	2.73	0.3379
	117	L	67.36	1.94	47.72	8.83	20.45	0.70	0.83	0.16	1.54	2.85	0.3972
	117	D	98.34	2.12	47.72	10.61	20.45	0.70	0.86	0.18	1.58	2.82	0.3465
	117	N	87.55	2.13	47.72	9.19	20.45	0.70	0.83	0.16	1.54	2.86	0.3869
CID <= 150	33	H	66.36	2.15	53.80	13.14	23.06	0.70	0.87	0.20	1.82	2.51	0.1186
	33	L	90.18	2.10	53.80	9.98	23.06	0.70	0.83	0.16	1.74	2.52	0.2359
	33	D	87.24	2.17	51.65	12.32	22.14	0.70	0.87	0.19	1.91	2.38	0.2108
	33	N	73.08	2.17	51.65	11.33	22.14	0.70	0.85	0.18	1.73	2.52	0.2439
150 TO 260	18	H	56.11	1.73	44.59	20.08	19.11	0.70	1.02	0.31	1.67	1.95	0.1476
	18	L	71.56	1.67	37.83	8.79	16.21	0.70	0.86	0.19	1.31	2.43	0.5082
	18	D	95.48	1.82	37.83	20.35	16.21	0.70	1.08	0.35	1.26	2.16	0.2599
	18	N	86.73	1.82	37.83	20.19	16.21	0.70	1.07	0.35	1.26	2.16	0.2632
CID >= 260	66	H	61.33	1.97	48.64	6.77	20.85	0.70	0.80	0.12	1.52	3.15	0.4430
	66	L	65.84	2.00	48.64	7.26	20.85	0.70	0.80	0.13	1.61	3.20	0.4284
	66	D	105.71	1.89	48.64	5.79	20.85	0.70	0.78	0.11	1.51	3.35	0.4718
	66	N	95.78	1.93	48.64	4.04	20.85	0.70	0.76	0.08	1.52	3.34	0.5235

TABLE 107

SUMMARY OF CONTINGENCY TABLE ANALYSIS-- HC -CONTINUED
GROUPED BY CID
FEDERAL SHORT CYCLE - 117 CAR FLEET (DENVER)
FIXED SHORT TEST EFFECTIVENESS; STE= 80%

CID	NO. OF VEHICLES	MODE	CUT POINTS ST UNITS	CUT POINTS FTP UNITS	% CORRECT FAILURES	% EC	% EO	STE	STRR	EC/(EC+FF)	FTP AVG FOR ST PASS	FTP AVG FOR ST FAIL	CORRELATION
ALL	117		1.01	1.78	54.45	5.67	13.61	0.80	0.88	0.09	1.26	2.81	0.5926
CID <= 150	33		0.96	1.95	58.58	3.90	14.65	0.80	0.85	0.06	1.22	2.56	0.5985
150 TO 260	18		0.71	1.64	43.23	16.10	10.81	0.80	1.10	0.27	1.17	2.22	0.4562
CID >= 260	66		1.14	1.76	55.59	3.99	13.90	0.80	0.86	0.07	1.40	3.10	0.6280

TABLE 108

SUMMARY OF CONTINGENCY TABLE ANALYSIS-- HC -CONTINUED
GROUPED BY CID
FEDERAL THREE-MODE - 117 CAR FLEET (DENVER)
FIXED SHORT TEST EFFECTIVENESS; STE= 80%

CID	NO. OF VEHICLES	MODE	CUT POINTS ST UNITS	CUT POINTS FTP UNITS	% CORRECT FAILURES	% EC	% EO	STE	STRR	EC/(EC+FF)	FTP AVG FOR ST PASS	FTP AVG FOR ST FAIL	CORRE-LATION
ALL	117	H	43.72	1.77	54.54	14.90	13.63	0.80	1.02	0.21	1.60	2.61	0.3354
	117	L	53.78	1.80	54.54	12.63	13.63	0.80	0.99	0.19	1.40	2.81	0.3998
	117	D	72.61	2.09	54.54	14.58	13.63	0.80	1.01	0.21	1.53	2.70	0.3446
	117	N	64.40	2.09	54.54	13.04	13.63	0.80	0.99	0.19	1.47	2.79	0.3884
CID <= 150	33	H	47.33	2.08	61.48	15.92	15.37	0.80	1.01	0.21	1.93	2.37	0.1131
	33	L	70.82	1.98	61.48	12.97	15.37	0.80	0.97	0.17	1.54	2.50	0.2320
	33	D	59.97	2.15	59.03	15.66	14.76	0.80	1.01	0.21	1.73	2.37	0.2050
	33	N	49.77	2.16	59.03	14.70	14.76	0.80	1.00	0.20	1.70	2.47	0.2391
150 TO 260	18	H	38.53	1.67	50.96	24.48	12.74	0.80	1.18	0.32	1.29	2.07	0.1403
	18	L	57.15	1.58	43.23	13.37	10.81	0.80	1.05	0.24	1.13	2.49	0.5119
	18	D	66.87	1.82	43.23	26.14	10.81	0.80	1.28	0.38	1.07	2.18	0.2500
	18	N	61.28	1.82	43.23	25.98	10.81	0.80	1.28	0.38	1.07	2.18	0.2533
CID >= 260	66	H	50.05	1.78	55.59	10.18	13.90	0.80	0.95	0.15	1.57	2.99	0.4526
	66	L	53.69	1.83	55.59	10.76	13.90	0.80	0.95	0.16	1.44	3.12	0.4360
	66	D	82.79	1.72	55.59	9.01	13.90	0.80	0.93	0.14	1.50	3.21	0.4861
	66	N	74.88	1.78	55.59	6.79	13.90	0.80	0.90	0.11	1.48	3.23	0.5488

TABLE 109

SUMMARY OF CONTINGENCY TABLE ANALYSIS-- CO
GROUPED BY CID
FEDERAL SHORT CYCLE - 117 CAR FLEET (DENVER)
FIXED SHORT TEST REJECTION RATIO; STRR= 100%

CID	NO. OF VEHICLES	MODE	CUT POINTS ST UNITS	CUT POINTS FTP UNITS	% CORRECT FAILURES	% EC	% EO	STE	STRR	EC/(EC+FF)	FTP AVG FOR ST PASS	FTP AVG FOR ST FAIL	CORRE-LATION
ALL	117		4.06	23.03	86.83	3.94	3.94	0.96	1.00	0.04	20.13	52.20	0.5294
CID <= 150	33		5.62	22.20	82.99	5.47	5.47	0.94	1.00	0.06	18.53	39.74	0.4644
150 TO 260	18		2.98	25.49	79.70	6.48	6.48	0.92	1.00	0.08	10.09	37.82	0.4557
CID >= 260	66		3.70	25.10	91.11	2.61	2.61	0.97	1.00	0.03	13.26	63.36	0.5560

TABLE 110

SUMMARY OF CONTINGENCY TABLE ANALYSIS-- CO
GROUPED BY CID
FEDERAL THREE-MODE - 117 CAR FLEET (DENVER)
FIXED SHORT TEST REJECTION RATIO: STRR= 100%

CID	NO. OF VEHICLES	MODE	CUT POINTS ST UNITS	CUT POINTS FTP UNITS	% CORRECT FAILURES	% EC	% EO	STE	STRR	EC/(EC+FF)	FTP AVG FOR ST PASS	FTP AVG FOR ST FAIL	CORRE-LATION
ALL	117	H	1465.23	25.63	84.91	5.86	5.86	0.94	1.00	0.06	25.55	52.56	0.3007
	117	L	924.17	27.89	85.09	5.68	5.68	0.94	1.00	0.06	25.67	53.96	0.3223
	117	D	605.19	27.74	84.77	6.00	6.00	0.93	1.00	0.07	29.96	54.79	0.2837
	117	N	481.52	27.27	85.06	5.72	5.72	0.94	1.00	0.06	28.61	51.36	0.3177
CID <= 150	33	H	2061.76	28.99	73.62	10.89	10.89	0.87	1.00	0.13	18.54	37.62	0.1684
	33	L	1254.70	25.39	75.08	9.43	9.43	0.89	1.00	0.11	18.54	37.62	0.2800
	33	D	1932.73	22.44	82.03	6.43	6.43	0.93	1.00	0.07	18.90	38.91	0.3699
	33	N	1374.98	25.11	82.00	6.46	6.46	0.93	1.00	0.07	18.47	39.75	0.3673
150 TO 260	18	H	965.50	29.81	73.63	11.27	11.27	0.87	1.00	0.13	29.44	35.80	0.1212
	18	L	480.73	28.50	78.55	7.63	7.63	0.91	1.00	0.09	20.74	38.73	0.3590
	18	D	498.00	24.63	78.50	7.68	7.68	0.91	1.00	0.09	16.91	38.30	0.3547
	18	N	421.06	22.76	78.74	7.44	7.44	0.91	1.00	0.09	20.74	38.73	0.3749
CID >= 260	66	H	1810.47	27.24	76.47	7.32	7.32	0.91	1.00	0.09	26.70	66.68	0.4614
	66	L	677.07	29.72	89.73	3.99	3.99	0.96	1.00	0.04	27.63	66.45	0.3225
	66	D	311.03	32.47	89.52	4.20	4.20	0.96	1.00	0.04	32.84	60.04	0.2869
	66	N	255.23	28.84	89.87	3.85	3.85	0.96	1.00	0.04	15.50	59.47	0.3450

TABLE 111

SUMMARY OF CONTINGENCY TABLE ANALYSIS-- CO
GROUPED BY CID
FEDERAL SHORT CYCLE - 117 CAR FLEET (DENVER)
EC/(EC+FF) = 10% AND 20%; EC/(EC+FF)= 10%

CID	NO. OF VEHICLES	MODE	CUT POINTS ST UNITS	CUT POINTS FTP UNITS	% CORRECT FAILURES	% EC	% EO	STE	STRR	EC/(EC+FF)	FTP AVG FOR ST PASS	FTP AVG FOR ST FAIL	CORRELATION
ALL	117		***** PARAMETRIC SOLUTION DOES NOT EXIST *****										
CID <= 150	33		2.68	19.97	88.00	9.78	0.46	0.99	1.11	0.10	41.31	35.71	0.3196
150 TO 260	18		1.95	24.67	83.86	9.32	2.32	0.97	1.08	0.10	6.42	36.40	0.4087
CID >= 260	66		***** PARAMETRIC SOLUTION DOES NOT EXIST *****										

TABLE 112

SUMMARY OF CONTINGENCY TABLE ANALYSIS-- CO
GROUPED BY CID
FEDERAL THREE-MODE - 117 CAR FLEET (DENVER)
EC/(EC+FF) = 10% AND 20%; EC/(EC+FF)= 10%

CID	NO. OF VEHICLES	MODE	CUT POINTS ST UNITS	CUT POINTS FTP UNITS	% CORRECT FAILURES	% EC	% EO	STE	STRR	EC/(EC+FF)	FTP AVG FOR ST PASS	FTP AVG FOR ST FAIL	CORRELATION
ALL	117	H	***** PARAMETRIC SOLUTION DOES NOT EXIST *****										
	117	L	***** PARAMETRIC SOLUTION DOES NOT EXIST *****										
	117	D	***** PARAMETRIC SOLUTION DOES NOT EXIST *****										
	117	N	***** PARAMETRIC SOLUTION DOES NOT EXIST *****										
CID <= 150	33	H	15241.08	34.53	52.12	5.79	32.39	0.62	0.69	0.10	26.01	46.37	0.1780
	33	L	4916.14	27.80	70.46	7.83	14.05	0.83	0.93	0.10	21.20	41.39	0.2881
	33	D	622.08	21.79	87.40	9.71	1.06	0.99	1.10	0.10	15.34	37.21	0.2797
	33	N	430.91	24.68	87.38	9.71	1.08	0.99	1.10	0.10	11.34	36.65	0.2784
150 TO 260	18	H	21386.07	35.42	39.88	4.43	45.02	0.47	0.52	0.10	35.01	34.02	0.1271
	18	L	311.92	28.42	81.46	9.05	4.72	0.95	1.05	0.10	16.91	38.30	0.3415
	18	D	308.93	24.59	81.31	9.03	4.87	0.94	1.05	0.10	16.91	38.30	0.3383
	18	N	227.87	22.67	81.97	9.11	4.21	0.95	1.06	0.10	10.06	37.82	0.3533
CID >= 260	66	H	***** PARAMETRIC SOLUTION DOES NOT EXIST *****										
	66	L	***** PARAMETRIC SOLUTION DOES NOT EXIST *****										
	66	D	***** PARAMETRIC SOLUTION DOES NOT EXIST *****										
	66	N	***** PARAMETRIC SOLUTION DOES NOT EXIST *****										

TABLE 113

SUMMARY OF CONTINGENCY TABLE ANALYSIS-- CO -CONTINUED
GROUPED BY CID
FEDERAL SHORT CYCLE - 117 CAR FLEET (DENVER)
EC/(EC+FF) = 10% AND 20%: EC/(EC+FF)= 20%

CID	NO. OF VEHICLES	MODE	CUT POINTS ST UNITS	CUT POINTS FTP UNITS	% CORRECT FAILURES	% EC	% EO	STE	STRR	EC/(EC+FF)	FTP AVG FOR ST PASS	FTP AVG FOR ST FAIL	CORRELATION
ALL	117			***** PARAMETRIC SOLUTION DOES NOT EXIST *****									
CID <= 150	33			***** PARAMETRIC SOLUTION DOES NOT EXIST *****									
150 TO 260	18			***** PARAMETRIC SOLUTION DOES NOT EXIST *****									
CID >= 280	66			***** PARAMETRIC SOLUTION DOES NOT EXIST *****									

TABLE 114

SUMMARY OF CONTINGENCY TABLE ANALYSIS-- CO -CONTINUED
GROUPED BY CID
FEDERAL THREE-MODE - 117 CAR FLEET (DENVER)
EC/(EC+FF) = 10% AND 20%; EC/(EC+FF)= 20%

CID	NO. OF VEHICLES	MODE	CUT POINTS ST UNITS	CUT POINTS FTP UNITS	% CORRECT FAILURES	% EC	% EO	STE	STRR	EC/(EC+FF)	FTP AVG FOR ST PASS	FTP AVG FOR ST FAIL	CORRELATION
ALL	117	H		***** PARAMETRIC SOLUTION DOES NOT EXIST *****									
	117	L		***** PARAMETRIC SOLUTION DOES NOT EXIST *****									
	117	D		***** PARAMETRIC SOLUTION DOES NOT EXIST *****									
	117	N		***** PARAMETRIC SOLUTION DOES NOT EXIST *****									
CID <= 150	33	H		***** PARAMETRIC SOLUTION DOES NOT EXIST *****									
	33	L		***** PARAMETRIC SOLUTION DOES NOT EXIST *****									
	33	D		***** PARAMETRIC SOLUTION DOES NOT EXIST *****									
	33	N		***** PARAMETRIC SOLUTION DOES NOT EXIST *****									
150 TO 260	18	H		***** PARAMETRIC SOLUTION DOES NOT EXIST *****									
	18	L		***** PARAMETRIC SOLUTION DOES NOT EXIST *****									
	18	D		***** PARAMETRIC SOLUTION DOES NOT EXIST *****									
	18	N		***** PARAMETRIC SOLUTION DOES NOT EXIST *****									
CID >= 260	66	H		***** PARAMETRIC SOLUTION DOES NOT EXIST *****									
	66	L		***** PARAMETRIC SOLUTION DOES NOT EXIST *****									
	66	D		***** PARAMETRIC SOLUTION DOES NOT EXIST *****									
	66	N		***** PARAMETRIC SOLUTION DOES NOT EXIST *****									

TABLE 115

SUMMARY OF CONTINGENCY TABLE ANALYSIS-- CO
GROUPED BY CID
FEDERAL SHORT CYCLE - 117 CAR FLEET (DENVER)
METHOD OF BOUNDED ERRORS OF COMMISSION; EC= 5%

CID	NO. OF VEHICLES	MODE	CUT POINTS ST UNITS	CUT POINTS FTP UNITS	% CORRECT FAILURES	% EC	% EO	STE	STRR	EC/(EC+FF)	FTP AVG FOR ST PASS	FTP AVG FOR ST FAIL	CORRE-LATION
ALL	117		3.28	22.28	88.52	5.00	2.25	0.98	1.03	0.05	21.73	50.88	0.5095
CID <= 150	33		6.01	22.50	81.94	5.00	6.52	0.93	0.98	0.06	18.53	39.74	0.4676
150 TO 260	18		3.70	26.08	76.12	5.00	10.06	0.88	0.94	0.06	28.76	35.93	0.4597
CID >= 260	66		1.73	23.17	93.51	5.00	0.21	1.00	1.05	0.05	9.66	60.34	0.4038

TABLE 116

SUMMARY OF CONTINGENCY TABLE ANALYSIS-- CO
GROUPED BY CID
FEDERAL THREE-MODE - 117 CAR FLEET (DENVER)
METHOD OF BOUNDED ERRORS OF COMMISSION; EC= 5%

CID	NO. OF VEHICLES	MODE	CUT POINTS ST UNITS	CUT POINTS FTP UNITS	% CORRECT FAILURES	% EC	% EO	STE	STRR	EC/(EC+FF)	FTP AVG FOR ST PASS	FTP AVG FOR ST FAIL	CORRELATION
ALL	117	H	1978.06	26.25	81.94	5.00	8.83	0.90	0.96	0.06	25.60	52.83	0.3100
	117	L	1191.10	28.21	82.91	5.00	7.86	0.91	0.97	0.06	25.17	54.38	0.3299
	117	D	984.23	28.03	81.10	5.00	9.67	0.89	0.95	0.06	29.70	55.47	0.2942
	117	N	674.82	27.44	82.71	5.00	8.06	0.91	0.97	0.06	28.27	55.98	0.3256
CID <= 150	33	H	17373.87	35.42	47.70	5.00	36.81	0.56	0.62	0.09	26.26	48.94	0.1751
	33	L	11520.56	32.16	59.06	5.00	25.45	0.70	0.76	0.08	22.00	47.45	0.2836
	33	D	2910.54	22.92	77.79	5.00	10.67	0.88	0.94	0.06	17.19	40.04	0.3776
	33	N	2114.90	25.45	77.65	5.00	10.81	0.88	0.93	0.06	17.07	40.95	0.3751
150 TO 260	18	H	19583.11	34.92	43.43	5.00	41.47	0.51	0.57	0.10	32.88	37.65	0.1293
	18	L	1049.13	28.75	70.39	5.00	15.79	0.82	0.87	0.07	20.79	41.71	0.3644
	18	D	9772.40	29.03	64.75	5.00	20.15	0.76	0.82	0.07	21.80	42.97	0.3364
	18	N	1940.52	23.49	73.85	5.00	11.05	0.87	0.93	0.06	21.80	42.97	0.4724
CID >= 260	66	H	7556.57	36.36	70.83	5.00	12.95	0.85	0.91	0.07	34.40	67.96	0.4625
	66	L	6753.17	39.03	69.05	5.00	14.74	0.82	0.88	0.07	32.11	69.60	0.4337
	66	D	11836.14	43.49	65.66	5.00	18.13	0.78	0.84	0.07	33.74	77.28	0.3848
	66	N	104.14	28.65	92.49	5.00	1.23	0.99	1.04	0.05	0.00	58.81	0.2960

TABLE 117

SUMMARY OF CONTINGENCY TABLE ANALYSIS-- CO
GROUPED BY CID
FEDERAL SHORT CYCLE - 117 CAR FLEET (DENVER)
FIXED SHORT TEST EFFECTIVENESS; STE= 60%

CID	NO. OF VEHICLES	MODE	CUT POINTS ST UNITS	CUT POINTS FTP UNITS	% CORRECT FAILURES	% EC	% EO	STE	STRR	EC/(EC+FF)	FTP AVG FOR ST PASS	FTP AVG FOR ST FAIL	CORRE-LATION
ALL	117		15.98	34.62	54.46	0.16	36.31	0.60	0.60	0.00	25.67	62.48	0.3387
CID <= 150	33		15.39	29.64	53.08	0.62	35.38	0.60	0.61	0.01	19.50	45.25	0.3503
150 TO 260	18		8.75	30.14	51.71	0.99	34.47	0.60	0.61	0.02	25.58	42.06	0.3649
CID >= 260	66		18.90	39.96	56.23	0.03	37.49	0.60	0.60	0.00	29.57	73.42	0.2914

TABLE 118

SUMMARY OF CONTINGENCY TABLE ANALYSIS-- CO
GROUPED BY CID
FEDERAL THREE-MODE - 117 CAR FLEET (DENVER)
FIXED SHORT TEST EFFECTIVENESS; STE= 60%

CID	NO. OF VEHICLES	MODE	CUT POINTS ST UNITS	CUT POINTS FTP UNITS	% CORRECT FAILURES	% EC	% EO	STE	STRR	EC/(EC+FF)	FTP AVG FOR ST PASS	FTP AVG FOR ST FAIL	CORRELATION
ALL	117	H	8371.97	34.04	54.46	1.35	36.31	0.60	0.61	0.02	30.76	55.96	0.2646
	117	L	6328.50	34.40	54.46	1.17	36.31	0.60	0.61	0.02	26.65	60.50	0.2755
	117	D	6443.25	32.31	54.46	1.50	36.31	0.60	0.62	0.03	29.38	58.27	0.2553
	117	N	5330.07	31.60	54.46	1.21	36.31	0.60	0.61	0.02	28.52	59.49	0.2733
CID <= 150	33	H	15931.16	34.82	50.71	5.53	33.80	0.60	0.67	0.10	26.01	46.37	0.1772
	33	L	15493.72	34.78	50.71	3.53	33.80	0.60	0.64	0.07	23.12	47.89	0.2701
	33	D	11285.51	27.08	53.08	1.30	35.38	0.60	0.61	0.02	20.91	42.39	0.3126
	33	N	8447.16	28.36	53.08	1.32	35.38	0.60	0.61	0.02	25.50	41.82	0.3113
150 TO 260	18	H	15730.05	33.87	50.94	6.30	33.96	0.60	0.67	0.11	29.08	41.80	0.1324
	18	L	3334.63	29.77	51.71	1.94	34.47	0.60	0.62	0.04	22.72	42.38	0.3179
	18	D	19821.45	33.75	50.94	2.62	33.96	0.60	0.63	0.05	23.16	43.99	0.3064
	18	N	23859.86	34.03	50.94	1.07	33.96	0.60	0.61	0.02	24.58	47.43	0.3791
CID >= 260	66	H	20897.30	57.52	50.27	1.33	33.51	0.60	0.62	0.03	38.22	85.07	0.3820
	66	L	18709.38	57.34	50.27	1.63	33.51	0.60	0.62	0.03	42.62	85.36	0.3683
	66	D	26019.34	57.04	50.27	2.22	33.51	0.60	0.63	0.04	40.76	84.87	0.3416
	66	N	4455.76	34.15	56.23	0.45	37.49	0.60	0.60	0.01	33.20	74.42	0.2584

TABLE 119

SUMMARY OF CONTINGENCY TABLE ANALYSIS-- CO -CONTINUED
GROUPED BY CID
FEDERAL SHORT CYCLE - 117 CAR FLEET (DENVER)
FIXED SHORT TEST EFFECTIVENESS: STE= 70%

CID	NO. OF VEHICLES	MODE	CUT POINTS ST UNITS	CUT POINTS FTP UNITS	% CORRECT FAILURES	% EC	% EO	STE	STRR	EC/(EC+FF)	FTP AVG FOR ST PASS	FTP AVG FOR ST FAIL	CORRE-LATION
ALL	117		12.18	30.92	63.54	0.39	27.23	0.70	0.70	0.01	22.58	60.69	0.3962
CID <= 150	33		12.35	27.32	61.92	1.18	26.54	0.70	0.71	0.02	18.97	44.34	0.3960
150 TO 260	18		6.79	28.56	60.33	1.78	25.86	0.70	0.72	0.03	25.20	39.50	0.4062
CID >= 260	66		14.11	35.27	65.60	0.09	28.12	0.70	0.70	0.00	22.40	69.51	0.3504

TABLE 120

SUMMARY OF CONTINGENCY TABLE ANALYSIS-- CO -CONTINUED
GROUPED BY CID
FEDERAL THREE-MODE - 117 CAR FLEET (DENVER)
FIXED SHORT TEST EFFECTIVENESS; STE= 70%

CID	NO. OF VEHICLES	MODE	CUT POINTS ST UNITS	CUT POINTS FTP UNITS	% CORRECT FAILURES	% EC	% EO	STE	STRR	EC/(EC+FF)	FTP AVG FOR ST PASS	FTP AVG FOR ST FAIL	CORRE-LATION
ALL	117	H	5734.24	30.83	63.54	2.10	27.23	0.70	0.72	0.03	29.37	55.28	0.2882
	117	L	4184.62	31.82	63.54	1.87	27.23	0.70	0.72	0.03	26.64	56.92	0.3024
	117	D	3839.64	30.27	63.54	2.28	27.23	0.70	0.73	0.03	28.16	58.11	0.2765
	117	N	3175.22	29.68	63.54	1.92	27.23	0.70	0.72	0.03	28.44	57.98	0.2994
CID <= 150	33	H	11647.52	33.02	59.16	7.20	25.35	0.70	0.79	0.11	25.82	41.63	0.1802
	33	L	11473.08	32.13	59.16	5.02	25.35	0.70	0.76	0.08	22.00	47.45	0.2837
	33	D	7526.21	25.21	61.92	2.13	26.54	0.70	0.72	0.03	20.89	41.51	0.3433
	33	N	5564.66	27.03	61.92	2.16	26.54	0.70	0.72	0.03	20.76	41.55	0.3416
150 TO 260	18	H	11075.85	32.59	59.43	7.95	25.47	0.70	0.79	0.12	29.41	37.40	0.1328
	18	L	2052.30	29.20	60.33	3.04	25.86	0.70	0.74	0.05	22.72	42.38	0.3439
	18	D	13905.70	30.97	59.43	3.92	25.47	0.70	0.75	0.06	23.16	43.99	0.3272
	18	N	16907.75	30.69	59.43	1.93	25.47	0.70	0.72	0.03	23.16	43.99	0.4210
CID >= 260	66	H	16088.78	49.89	58.65	2.31	25.14	0.70	0.73	0.04	38.11	82.17	0.4211
	66	L	13877.16	49.94	58.65	2.72	25.14	0.70	0.73	0.04	38.72	75.55	0.4028
	66	D	18748.35	50.09	58.65	3.49	25.14	0.70	0.74	0.06	35.58	79.38	0.3685
	66	N	2607.10	31.81	65.60	0.81	28.12	0.70	0.71	0.01	33.93	72.11	0.2930

TABLE 121

SUMMARY OF CONTINGENCY TABLE ANALYSIS-- CO -CONTINUED
GROUPED BY CID
FEDERAL SHORT CYCLE - 117 CAR FLEET (DENVER)
FIXED SHORT TEST EFFECTIVENESS; STE= 80%

CID	NO. OF VEHICLES	MODE	CUT POINTS ST UNITS	CUT POINTS FTP UNITS	% CORRECT FAILURES	% EC	% EO	STE	STRR	EC/(EC+FF)	FTP AVG FOR ST PASS	FTP AVG FOR ST FAIL	CORRE-LATION
ALL	117		8.95	27.78	72.62	0.92	18.15	0.80	0.81	0.01	18.98	57.97	0.4592
CID <= 150	33		9.59	25.23	70.77	2.18	17.69	0.80	0.82	0.03	17.06	42.94	0.4393
150 TO 260	18		5.07	27.18	68.95	3.11	17.24	0.80	0.84	0.04	26.73	37.02	0.4422
CID >= 260	66		10.14	31.39	74.98	0.29	18.74	0.80	0.80	0.00	17.31	68.03	0.4241

TABLE 122

SUMMARY OF CONTINGENCY TABLE ANALYSIS-- CO -CONTINUED
GROUPED BY CID
FEDERAL THREE-MODE - 117 CAR FLEET (DENVER)
FIXED SHORT TEST EFFECTIVENESS; STE= 80%

CID	NO. OF VEHICLES	MODE	CUT POINTS ST UNITS	CUT POINTS FTP UNITS	% CORRECT FAILURES	% EC	% EO	STE	STRR	EC/(EC+FF)	FTP AVG FOR ST PASS	FTP AVG FOR ST FAIL	CORRE-LATION
ALL	117	H	3694.65	28.34	72.62	3.20	18.15	0.80	0.84	0.04	26.21	54.13	0.3067
	117	L	2589.96	29.90	72.62	2.94	18.15	0.80	0.83	0.04	25.12	55.36	0.3244
	117	D	2103.25	26.91	72.62	3.40	18.15	0.80	0.84	0.04	28.63	56.83	0.2923
	117	N	1740.87	28.40	72.62	2.99	18.15	0.80	0.83	0.04	28.99	57.37	0.3206
CID <= 150	33	H	6639.99	30.91	67.61	9.19	16.90	0.80	0.91	0.12	25.10	40.57	0.1772
	33	L	6789.14	29.04	67.61	7.00	16.90	0.80	0.88	0.09	20.36	44.75	0.2893
	33	D	4710.30	23.82	70.77	3.41	17.69	0.80	0.84	0.05	19.52	40.29	0.3683
	33	N	3433.21	26.05	70.77	3.45	17.69	0.80	0.84	0.05	17.07	40.95	0.3662
150 TO 260	18	H	5631.47	31.09	67.92	9.83	16.98	0.80	0.92	0.13	27.37	36.84	0.1286
	18	L	1169.33	28.81	68.95	4.65	17.24	0.80	0.85	0.06	20.79	41.71	0.3626
	18	D	7034.37	27.75	67.92	5.77	16.98	0.80	0.87	0.08	21.80	42.97	0.3398
	18	N	8934.88	26.85	67.92	3.36	16.98	0.80	0.84	0.05	21.80	42.97	0.4569
CID >= 260	66	H	10565.02	41.13	67.03	3.92	16.76	0.80	0.85	0.06	36.44	72.45	0.4531
	66	L	8308.30	41.41	67.03	4.44	16.76	0.80	0.85	0.06	33.00	71.71	0.4294
	66	D	10330.87	42.05	67.03	5.36	16.76	0.80	0.86	0.07	33.82	76.10	0.3869
	66	N	1402.83	30.29	74.98	1.43	18.74	0.80	0.82	0.02	33.93	72.11	0.3272

TABLE 123

SUMMARY OF CONTINGENCY TABLE ANALYSIS-- NOX
GROUPED BY CID
FEDERAL SHORT CYCLE - 117 CAR FLEET (DENVER)
FIXED SHORT TEST REJECTION RATIO; STRR= 100%

CID	NO. OF VEHICLES	MODE	CUT POINTS ST UNITS	CUT POINTS FTP UNITS	% CORRECT FAILURES	% EC	% EO	STE	STRR	EC/(EC+FF)	FTP AVG FOR ST PASS	FTP AVG FOR ST FAIL	CORRE-LATION
ALL	117		2.95	3.01	3.29	2.38	2.38	0.58	1.00	0.42	1.55	3.96	0.5551
CID <= 150	33		2.56	2.93	3.68	2.04	2.04	0.64	1.00	0.36	1.49	4.10	0.6221
150 TO 260	18		3.26	3.07	6.33	1.32	1.32	0.83	1.00	0.17	1.72	3.47	0.8125
CID >= 260	66		3.04	3.10	1.99	2.05	2.05	0.49	1.00	0.51	1.54	4.86	0.4707

TABLE 124

SUMMARY OF CONTINGENCY TABLE ANALYSIS-- NOX
GROUPED BY CID
FEDERAL THREE-MODE - 117 CAR FLEET (DENVER)
FIXED SHORT TEST REJECTION RATIO: STRR= 100%

CID	NO. OF VEHICLES	MODE	CUT POINTS ST UNITS	CUT POINTS FTP UNITS	% CORRECT FAILURES	% EC	% EO	STE	STRR	EC/(EC+FF)	FTP AVG FOR ST PASS	FTP AVG FOR ST FAIL	CORRE-LATION
ALL	117	H	2441.75	2.94	1.97	3.69	3.69	0.35	1.00	0.65	1.62	3.31	0.3090
	117	L	1773.78	3.18	1.98	3.68	3.68	0.35	1.00	0.65	1.60	4.19	0.3112
	117	D	267.51	2.04	0.87	4.79	4.79	0.15	1.00	0.85	1.66	2.12	0.1034
	117	N	109.24	2.20	0.83	4.83	4.83	0.15	1.00	0.85	1.64	2.72	0.0951
CID <= 150	33	H	3089.33	2.81	2.82	2.89	2.89	0.49	1.00	0.51	1.57	0.00	0.4632
	33	L	1348.03	2.63	0.97	1.90	1.90	0.34	1.00	0.66	1.50	2.72	0.3168
	33	D	105.62	1.86	0.20	2.67	2.67	0.07	1.00	0.93	1.58	1.48	0.0406
	33	N	102.80	1.81	0.85	4.86	4.86	0.15	1.00	0.85	1.60	1.13	0.0977
150 TO 260	18	H	2134.78	2.81	6.12	5.52	5.52	0.53	1.00	0.47	1.80	2.85	0.4637
	18	L	1616.55	2.71	3.17	4.48	4.48	0.41	1.00	0.59	1.90	2.18	0.3663
	18	D	387.02	2.37	4.83	6.81	6.81	0.41	1.00	0.59	1.80	2.48	0.3376
	18	N	118.60	2.49	2.15	5.50	5.50	0.28	1.00	0.72	1.90	2.16	0.2214
CID >= 260	66	H	2167.86	3.59	1.17	2.87	2.87	0.29	1.00	0.71	1.60	4.46	0.2592
	66	L	1707.18	3.31	0.97	3.07	3.07	0.24	1.00	0.76	1.54	4.86	0.2085
	66	D	317.56	2.00	0.31	3.73	3.73	0.08	1.00	0.92	1.69	1.83	0.0371
	66	N	109.59	2.27	0.35	3.68	3.68	0.09	1.00	0.91	1.63	3.58	0.0492

TABLE 125

SUMMARY OF CONTINGENCY TABLE ANALYSIS-- NOX
GROUPED BY CID
FEDERAL SHORT CYCLE - 117 CAR FLEET (DENVER)
EC/(EC+FF) = 10% AND 20%: EC/(EC+FF)= 10%

CID	NO. OF VEHICLES	MODE	CUT POINTS ST UNITS	FTP UNITS	% CORRECT FAILURES	% EC	% EO	STE	STRR	EC/(EC+FF)	FTP AVG FOR ST PASS	FAIL	CORRELATION
ALL	117		4.65	4.44	0.82	0.09	4.84	0.15	0.16	0.10	1.65	6.37	0.3508
CID <= 150	33		3.48	3.87	1.49	0.17	4.22	0.26	0.29	0.10	1.49	4.10	0.4718
150 TO 260	18		3.37	3.16	5.54	0.62	2.11	0.72	0.80	0.10	1.72	3.47	0.7935
CID >= 260	66		***** PRACTICAL SOLUTION DOES NOT EXIST *****										

TABLE 126

SUMMARY OF CONTINGENCY TABLE ANALYSIS-- NOX
GROUPED BY CID
FEDERAL THREE-MODE - 117 CAR FLEET (DENVER)
EC/(EC+FF) = 10% AND 20%: EC/(EC+FF)= 10%

CID	NO. OF VEHICLES	MODE	CUT POINTS ST UNITS	CUT POINTS FTP UNITS	% CORRECT FAILURES	% EC	% EO	STE	STRR	EC/(EC+FF)	FTP AVG FOR ST PASS	FTP AVG FOR ST FAIL	CORRELATION
ALL	117	H		***** PRACTICAL SOLUTION DOES NOT EXIST *****									
	117	L		***** PRACTICAL SOLUTION DOES NOT EXIST *****									
	117	D		***** PRACTICAL SOLUTION DOES NOT EXIST *****									
	117	N		***** PRACTICAL SOLUTION DOES NOT EXIST *****									
CID <= 150	33	H		***** PRACTICAL SOLUTION DOES NOT EXIST *****									
	33	L		***** PRACTICAL SOLUTION DOES NOT EXIST *****									
	33	D		***** PRACTICAL SOLUTION DOES NOT EXIST *****									
	33	N		***** PRACTICAL SOLUTION DOES NOT EXIST *****									
150 TO 260	18	H	6543.09	6.35	0.59	0.07	11.05	0.05	0.06	0.10	1.91	0.00	0.1991
	18	L		***** PRACTICAL SOLUTION DOES NOT EXIST *****									
	18	D		***** PRACTICAL SOLUTION DOES NOT EXIST *****									
	18	N		***** PRACTICAL SOLUTION DOES NOT EXIST *****									
CID >= 260	66	H		***** PRACTICAL SOLUTION DOES NOT EXIST *****									
	66	L		***** PRACTICAL SOLUTION DOES NOT EXIST *****									
	66	D		***** PRACTICAL SOLUTION DOES NOT EXIST *****									
	66	N		***** PRACTICAL SOLUTION DOES NOT EXIST *****									

TABLE 127

SUMMARY OF CONTINGENCY TABLE ANALYSIS-- NOX -CONTINUED
GROUPED BY CID
FEDERAL SHORT CYCLE - 117 CAR FLEET (DENVER)
EC/(EC+FF) = 10% AND 20%; EC/(EC+FF)= 20%

CID	NO. OF VEHICLES	MODE	CUT POINTS ST UNITS	CUT POINTS FTP UNITS	% CORRECT FAILURES	% EC	% EO	STE	STRR	EC/(EC+FF)	FTP AVG FOR ST PASS	FTP AVG FOR ST FAIL	CORRE-LATION
ALL	117		3.89	3.80	1.60	0.40	4.07	0.28	0.35	0.20	1.61	4.86	0.4588
CID <= 150	33		3.02	3.40	2.44	0.61	3.27	0.43	0.53	0.20	1.49	4.10	0.5679
150 TO 260	18		3.23	3.04	6.54	1.63	1.11	0.85	1.07	0.20	1.72	3.4	0.8119
CID >= 260	66		4.63	4.40	0.53	0.13	3.51	0.13	0.16	0.20	1.62	6.37	0.3141

TABLE 128

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              SUMMARY OF CONTINGENCY TABLE ANALYSIS-- NOX -CONTINUED
                     GROUPED BY       CID
                     FEDERAL THREE-MODE - 117 CAR FLEET (DENVER)
                     EC/(EC+FF) = 10%  AND 20%  EC/(EC+FF)=  20%

                 NO.   M                           %
                 OF    O      CUT POINTS        CORRECT     %         %                                FTP AVG
     CID       VEHICLES D  ST UNITS  FTP UNITS  FAILURES    EC        EO       STE    STRR  EC/(EC+FF)  FOR ST       CORRE-
                       E                                                                               PASS   FAIL   LATION

ALL              117   H             *****  PRACTICAL SOLUTION DOES NOT EXIST *****
                 117   L             *****  PRACTICAL SOLUTION DOES NOT EXIST *****
                 117   D             *****  PRACTICAL SOLUTION DOES NOT EXIST *****
                 117   N             *****  PRACTICAL SOLUTION DOES NOT EXIST *****

CID <= 150        33   H   5358.43       4.36      0.70      0.18      5.01     0.12    0.15    0.20     1.57   0.00   0.3012
                  33   L             *****  PRACTICAL SOLUTION DOES NOT EXIST *****
                  33   D             *****  PRACTICAL SOLUTION DOES NOT EXIST *****
                  33   N             *****  PRACTICAL SOLUTION DOES NOT EXIST *****

150 TO 260        18   H   4448.92       4.67      1.67      0.42      9.97     0.14    0.18    0.20     1.91   0.00   0.3113
                  18   L             *****  PRACTICAL SOLUTION DOES NOT EXIST *****
                  18   D             *****  PRACTICAL SOLUTION DOES NOT EXIST *****
                  18   N             *****  PRACTICAL SOLUTION DOES NOT EXIST *****

CID >= 260        66   H             *****  PRACTICAL SOLUTION DOES NOT EXIST *****
                  66   L             *****  PRACTICAL SOLUTION DOES NOT EXIST *****
                  66   D             *****  PRACTICAL SOLUTION DOES NOT EXIST *****
                  66   N             *****  PRACTICAL SOLUTION DOES NOT EXIST *****
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TABLE 129

SUMMARY OF CONTINGENCY TABLE ANALYSIS-- NOX
GROUPED BY CID
FEDERAL SHORT CYCLE - 117 CAR FLEET (DENVER)
METHOD OF BOUNDED ERRORS OF COMMISSION: EC= 5%

CID	NO. OF VEHICLES	MODE	CUT POINTS ST UNITS	CUT POINTS FTP UNITS	% CORRECT FAILURES	% EC	% EO	STE	STRR	EC7(EC+FF)	FTP AVG FOR ST PASS	FTP AVG FOR ST FAIL	CORRE- LATION
ALL	117		2.54	2.66	4.19	5.00	1.48	0.74	1.62	0.54	1.52	3.52	0.5490
CID <= 150	33		2.19	2.56	4.69	5.00	1.03	0.82	1.70	0.52	1.49	4.10	0.6022
150 TO 260	18		2.99	2.85	7.42	5.00	0.23	0.97	1.62	0.40	1.72	3.47	0.7380
CID >= 260	66		2.52	2.67	2.78	5.00	1.26	0.69	1.93	0.64	1.52	3.76	0.4673

TABLE 130

SUMMARY OF CONTINGENCY TABLE ANALYSIS-- NOX
GROUPED BY CID
FEDERAL THREE-MODE - 117 CAR FLEET (DENVER)
METHOD OF BOUNDED ERRORS OF COMMISSION: EC= 5%

CID	NO. OF VEHICLES	MODE	CUT POINTS ST UNITS	CUT POINTS FTP UNITS	% CORRECT FAILURES	% EC	% EO	STE	STRR	EC/(EC+FF)	FTP AVG FOR ST PASS	FTP AVG FOR ST FAIL	CORRE-LATION
ALL	117	H	2226.67	2.75	2.32	5.00	3.34	0.41	1.29	0.68	1.60	2.92	0.3164
	117	L	1567.75	2.93	2.34	5.00	3.33	0.41	1.30	0.68	1.60	4.19	0.3187
	117	D	262.73	2.03	0.90	5.00	4.76	0.16	1.04	0.85	1.66	2.01	0.1043
	117	N	108.25	2.19	0.85	5.00	4.81	0.15	1.03	0.85	1.64	2.72	0.0958
CID <= 150	33	H	2674.86	2.53	3.52	5.00	2.20	0.62	1.49	0.59	1.55	1.99	0.4676
	33	L	1198.68	2.42	1.54	5.00	1.33	0.54	2.28	0.76	1.50	2.31	0.3273
	33	D	97.86	1.82	0.33	5.00	2.54	0.12	1.86	0.94	1.60	1.30	0.0475
	33	N	102.08	1.81	0.87	5.00	4.84	0.15	1.03	0.85	1.60	1.13	0.0983
150 TO 260	18	H	2211.37	2.87	5.87	5.00	5.77	0.50	0.93	0.46	1.80	2.85	0.4611
	18	L	1589.43	2.69	3.35	5.00	4.30	0.44	1.09	0.60	1.90	2.18	0.3692
	18	D	447.11	2.51	4.07	5.00	7.57	0.35	0.78	0.55	1.80	2.85	0.3271
	18	N	120.14	2.51	2.02	5.00	5.63	0.26	0.92	0.71	1.90	2.16	0.2186
CID >= 260	66	H	1863.41	3.15	1.59	5.00	2.45	0.39	1.63	0.76	1.54	4.86	0.2715
	66	L	1399.00	2.90	1.31	5.00	2.73	0.32	1.56	0.79	1.54	3.56	0.2202
	66	D	281.31	1.95	0.40	5.00	3.64	0.10	1.34	0.93	1.69	1.60	0.0401
	66	N	101.04	2.19	0.46	5.00	3.58	0.11	1.35	0.92	1.63	3.58	0.0530

TABLE 131

SUMMARY OF CONTINGENCY TABLE ANALYSIS-- NOX
GROUPED BY CID
FEDERAL SHORT CYCLE - 117 CAR FLEET (DENVER)
FIXED SHORT TEST EFFECTIVENESS; STE= 60%

CID	NO. OF VEHICLES	MODE	CUT POINTS		% CORRECT FAILURES	% EC	% EO	STE	STRR	EC/(EC+FF)	FTP AVG FOR ST		CORRE-LATION
			ST UNITS	FTP UNITS							PASS	FAIL	
ALL	117		2.90	2.96	3.40	2.61	2.27	0.60	1.06	0.43	1.55	3.96	0.5566
CID <= 150	33		2.65	3.02	3.43	1.63	2.29	0.60	0.89	0.32	1.49	4.10	0.6173
150 TO 260	18		3.49	3.26	4.59	0.23	3.06	0.60	0.63	0.05	1.72	3.47	0.7417
CID >= 260	66		2.75	2.86	2.42	3.39	1.62	0.60	1.44	0.58	1.53	4.17	0.4751

TABLE 132

SUMMARY OF CONTINGENCY TABLE ANALYSIS-- NOX
GROUPED BY CID
FEDERAL THREE-MODE - 117 CAR FLEET (DENVER)
FIXED SHORT TEST EFFECTIVENESS; STE= 60%

CID	NO. OF VEHICLES	MODE	CUT POINTS ST UNITS	FTP UNITS	% CORRECT FAILURES	% EC	% EO	STE	STRR	EC/(EC+FF)	FTP AVG FOR ST PASS	FAIL	CORRELATION
ALL	117	H	1693.49	2.29	3.40	11.00	2.27	0.60	2.54	0.76	1.52	2.85	0.3183
	117	L	1097.22	2.34	3.40	10.87	2.27	0.60	2.52	0.76	1.50	2.70	0.3204
	117	D	91.92	1.68	3.40	32.48	2.27	0.60	6.33	0.91	1.61	1.88	0.1232
	117	N	53.94	1.71	3.40	33.92	2.27	0.60	6.59	0.91	1.51	1.98	0.1149
CID <= 150	33	H	2725.12	2.56	3.43	4.68	2.29	0.60	1.42	0.58	1.55	1.99	0.4681
	33	L	1151.56	2.35	1.72	6.53	1.15	0.60	2.88	0.79	1.50	2.31	0.3233
	33	D	59.21	1.60	1.72	40.94	1.15	0.60	14.87	0.96	1.48	1.74	0.0602
	33	N	54.20	1.59	3.43	33.53	2.29	0.60	6.47	0.91	1.50	1.71	0.1175
150 TO 260	18	H	1895.12	2.61	6.98	7.55	4.66	0.60	1.25	0.52	1.69	3.04	0.4681
	18	L	1406.79	2.51	4.59	9.81	3.06	0.60	1.88	0.68	1.80	2.85	0.3739
	18	D	261.18	2.09	6.98	14.14	4.66	0.60	1.81	0.67	1.71	2.44	0.3457
	18	N	93.17	2.19	4.59	20.14	3.06	0.60	3.23	0.81	1.79	2.55	0.2353
CID >= 260	66	H	1418.26	2.51	2.42	11.70	1.62	0.60	3.50	0.83	1.52	3.34	0.2703
	66	L	793.40	2.08	2.42	15.68	1.62	0.60	4.48	0.87	1.50	2.89	0.2232
	66	D	73.89	1.66	2.42	44.48	1.62	0.60	11.61	0.95	1.55	1.84	0.0538
	66	N	44.93	1.67	2.42	41.11	1.62	0.60	10.78	0.94	1.53	1.86	0.0681

TABLE 133

SUMMARY OF CONTINGENCY TABLE ANALYSIS-- NOX -CONTINUED
GROUPED BY CID
FEDERAL SHORT CYCLE - 117 CAR FLEET (DENVER)
FIXED SHORT TEST EFFECTIVENESS: STE= 70%

CID	NO. OF VEHICLES	MODE	CUT POINTS ST UNITS	CUT POINTS FTP UNITS	% CORRECT FAILURES	% EC	% EO	STE	STRR	EC/(EC+FF)	FTP AVG FOR ST PASS	FTP AVG FOR ST FAIL	CORRE-LATION
ALL	117		2.64	2.75	3.96	4.17	1.70	0.70	1.44	0.51	1.53	3.60	0.5546
CID <= 150	33		2.45	2.82	4.00	2.70	1.71	0.70	1.17	0.40	1.49	4.10	0.6234
150 TO 260	18		3.39	3.18	5.36	0.51	2.30	0.70	0.77	0.09	1.72	3.47	0.7854
CID >= 260	66		2.49	2.64	2.83	5.28	1.21	0.70	2.01	0.65	1.52	3.76	0.4653

TABLE 134

SUMMARY OF CONTINGENCY TABLE ANALYSIS-- NOX -CONTINUED
GROUPED BY CID
FEDERAL THREE-MODE - 117 CAR FLEET (DENVER)
FIXED SHORT TEST EFFECTIVENESS; STE= 70%

CID	NO. OF VEHICLES	MODE	CUT POINTS ST UNITS	CUT POINTS FTP UNITS	% CORRECT FAILURES	% EC	% EO	STE	STRR	EC/(EC+FF)	FTP AVG FOR ST PASS	FTP AVG FOR ST FAIL	CORRE-LATION
ALL	117	H	1452.81	2.09	3.96	15.96	1.70	0.70	3.52	0.80	1.46	2.74	0.3072
	117	L	895.66	2.09	3.96	15.78	1.70	0.70	3.49	0.80	1.46	2.58	0.3093
	117	D	73.22	1.64	3.96	41.99	1.70	0.70	8.11	0.91	1.51	1.91	0.1182
	117	N	46.59	1.65	3.96	43.57	1.70	0.70	8.39	0.92	1.52	1.90	0.1102
CID <= 150	33	H	2403.86	2.34	4.00	7.18	1.71	0.70	1.96	0.64	1.51	2.22	0.4594
	33	L	1073.25	2.23	2.01	9.81	0.86	0.70	4.12	0.83	1.44	2.33	0.3098
	33	D	51.99	1.56	2.01	51.25	0.86	0.70	18.56	0.96	1.40	1.76	0.0577
	33	N	47.39	1.55	4.00	43.14	1.71	0.70	8.25	0.92	1.54	1.63	0.1127
150 TO 260	18	H	1597.66	2.38	8.15	11.33	3.49	0.70	1.67	0.58	1.70	2.66	0.4631
	18	L	1286.18	2.39	5.36	14.35	2.30	0.70	2.58	0.73	1.77	2.40	0.3639
	18	D	208.28	1.97	8.15	20.04	3.49	0.70	2.42	0.71	1.71	2.44	0.3373
	18	N	84.92	2.09	5.36	27.60	2.30	0.70	4.31	0.84	1.72	2.41	0.2268
CID >= 260	66	H	1231.17	2.25	2.83	16.91	1.21	0.70	4.89	0.86	1.51	3.19	0.2591
	66	L	639.21	1.87	2.83	22.12	1.21	0.70	6.18	0.89	1.46	2.53	0.2136
	66	D	58.45	1.64	2.83	54.73	1.21	0.70	14.25	0.95	1.46	1.82	0.0516
	66	N	38.67	1.61	2.83	51.31	1.21	0.70	13.41	0.95	1.55	1.76	0.0653

TABLE 135

SUMMARY OF CONTINGENCY TABLE ANALYSIS-- NOX -CONTINUED
GROUPED BY CID
FEDERAL SHORT CYCLE - 117 CAR FLEET (DENVER)
FIXED SHORT TEST EFFECTIVENESS; STE= 80%

CID	NO. OF VEHICLES	MODE	CUT POINTS ST UNITS	CUT POINTS FTP UNITS	% CORRECT FAILURES	% EC	% EO	STE	STRR	FC/(EC+FF)	FTP AVG FOR ST PASS	FTP AVG FOR ST FAIL	CORRE-LATION
ALL	117		2.38	2.52	4.53	6.70	1.13	0.80	1.98	0.60	1.51	3.40	0.5336
CID <= 150	33		2.24	2.60	4.57	4.48	1.14	0.80	1.58	0.50	1.49	4.10	0.6086
150 TO 260	18		3.29	3.09	6.12	1.08	1.53	0.80	0.94	0.15	1.72	3.47	0.8104
CID >= 260	66		2.22	2.42	3.23	8.31	0.81	0.80	2.86	0.72	1.52	3.41	0.4395

TABLE 136

SUMMARY OF CONTINGENCY TABLE ANALYSIS-- NOX -CONTINUED
GROUPED BY CID
FEDERAL THREE-MODE - 117 CAR FLEET (DENVER)
FIXED SHORT TEST EFFECTIVENESS; STE= 80%

CID	NO. OF VEHICLES	MODE	CUT POINTS ST UNITS	CUT POINTS FTP UNITS	% CORRECT FAILURES	% EC	% EO	STE	STRR	EC/(EC+FF)	FTP AVG FOR ST PASS	FTP AVG FOR ST FAIL	CORRE-LATION
ALL	117	H	1214.83	1.88	4.53	23.24	1.13	0.80	4.90	0.84	1.44	2.43	0.2858
	117	L	706.76	1.85	4.53	23.01	1.13	0.80	4.86	0.84	1.43	2.39	0.2878
	117	D	56.11	1.61	4.53	53.51	1.13	0.80	10.25	0.92	1.41	1.87	0.1090
	117	N	39.25	1.58	4.53	55.11	1.13	0.80	10.53	0.92	1.47	1.80	0.1017
CID <= 150	33	H	2078.13	2.12	4.57	11.14	1.14	0.80	2.75	0.71	1.43	2.22	0.4349
	33	L	981.93	2.10	2.30	14.91	0.57	0.80	5.99	0.87	1.40	2.35	0.2860
	33	D	43.55	1.51	2.30	63.02	0.57	0.80	22.76	0.96	1.29	1.73	0.0530
	33	N	40.51	1.52	4.57	54.67	1.14	0.80	10.37	0.92	1.36	1.71	0.1040
150 TO 260	18	H	1310.25	2.15	9.31	17.03	2.33	0.80	2.26	0.65	1.62	2.68	0.4422
	18	L	1145.60	2.25	6.12	21.08	1.53	0.80	3.56	0.78	1.71	2.44	0.3415
	18	D	159.93	1.86	9.31	28.34	2.33	0.80	3.23	0.75	1.53	2.52	0.3172
	18	N	75.27	1.98	6.12	37.60	1.53	0.80	5.71	0.86	1.49	2.45	0.2105
CID >= 260	66	H	1043.65	1.98	3.23	24.54	0.81	0.80	6.88	0.88	1.47	2.45	0.2392
	66	L	496.54	1.68	3.23	31.20	0.81	0.80	8.53	0.91	1.45	2.20	0.1968
	66	D	44.42	1.62	3.23	66.07	0.81	0.80	17.16	0.95	1.47	1.77	0.0476
	66	N	32.44	1.56	3.23	62.89	0.81	0.80	16.38	0.95	1.58	1.73	0.0601

TABLE 137

SUMMARY OF CONTINGENCY TABLE ANALYSIS-- CMP3
GROUPED BY CID
FEDERAL SHORT CYCLE - 117 CAR FLEET (DENVER)
FIXED SHORT TEST REJECTION RATIO; STRR= 100%

CID	NO. OF VEHICLES	MODE	CUT POINTS ST UNITS	CUT POINTS FTP UNITS	% CORRECT FAILURES	% EC	% EO	STE	STRR	EC/(EC+FF)	FTP AVG FOR ST PASS	FTP AVG FOR ST FAIL	CORRELATION
ALL	117				87.18	4.27	4.27	0.95	1.00	0.05			0.4533
CID <= 150	33				84.85	0.00	9.09	0.90	0.90	0.00			0.6011
150 TO 260	18				83.33	5.56	0.00	1.00	1.07	0.06			0.7906
CID >= 260	66				90.91	3.03	1.52	0.98	1.02	0.03			0.6472

TABLE 138

SUMMARY OF CONTINGENCY TABLE ANALYSIS-- CMP3
GROUPED BY CID
FEDERAL THREE-MODE - 117 CAR FLEET (DENVER)
FIXED SHORT TEST REJECTION RATIO: STRR= 100%

CID	NO. OF VEHICLES	MODE	CUT POINTS ST UNITS	CUT POINTS FTP UNITS	% CORRECT FAILURES	% EC	% EO	STE	STRR	EC/(EC+FF)	FTP AVG FOR ST PASS	FTP AVG FOR ST FAIL	CORRELATION
ALL	117	H			85.47	3.42	5.98	0.93	0.97	0.04			0.4756
	117	L			82.05	3.42	9.40	0.90	0.93	0.04			0.3945
	117	D			76.07	3.42	15.38	0.83	0.87	0.04			0.2990
	117	N			85.47	5.13	5.98	0.93	0.99	0.06			0.3205
		B			82.91	3.42	8.55	0.91	0.94	0.04			0.4122
CID <= 150	33	H			90.91	0.00	3.03	0.97	0.97	0.00			0.8032
	33	L			90.91	0.00	3.03	0.97	0.97	0.00			0.8032
	33	D			84.85	0.00	9.09	0.90	0.90	0.00			0.6011
	33	N			81.82	3.03	12.12	0.87	0.90	0.04			0.2469
		B			84.85	0.00	9.09	0.90	0.90	0.00			0.6011
150 TO 260	18	H			77.78	5.56	5.56	0.93	1.00	0.07			0.6000
	18	L			72.22	5.56	11.11	0.87	0.93	0.07			0.4781
	18	D			83.33	11.11	0.00	1.00	1.13	0.12			0.5423
	18	N			77.78	5.56	5.56	0.93	1.00	0.07			0.6000
		B			77.78	5.56	5.56	0.93	1.00	0.07			0.6000
CID >= 260	66	H			83.33	4.55	9.09	0.90	0.95	0.05			0.2446
	66	L			83.33	3.03	9.09	0.90	0.93	0.04			0.3868
	66	D			87.88	7.58	4.55	0.95	1.03	0.08			-0.0625
	66	N			90.91	7.58	1.52	0.98	1.07	0.08			-0.0355
		B			83.33	4.55	9.09	0.90	0.95	0.05			0.2446

TABLE 139

SUMMARY OF CONTINGENCY TABLE ANALYSIS-- CMP3
GROUPED BY CID
FEDERAL SHORT CYCLE - 117 CAR FLEET (DENVER)
EC/(EC+FF) = 10% AND 20%: EC/(EC+FF)= 10%

CID	NO. OF VEHICLES	MODE	CUT POINTS ST UNITS	CUT POINTS FTP UNITS	% CORRECT FAILURES	% EC	% EQ	STE	STRR	EC/(EC+FF)	FTP AVG FOR ST PASS	FTP AVG FOR ST FAIL	CORRELATION
ALL	117		***** PARAMETRIC SOLUTION DOES NOT EXIST *****										
CID <= 150	33				90.91	6.06	3.03	0.97	1.03	0.06			-0.0449
150 TO 260	18				83.33	11.11	0.00	1.00	1.13	0.12			0.5423
CID >= 260	66		***** PRACTICAL SOLUTION DOES NOT EXIST *****										

TABLE 140

SUMMARY OF CONTINGENCY TABLE ANALYSIS-- CMP3
GROUPED BY CID
FEDERAL THREE-MODE - 117 CAR FLEET (DENVER)
EC/(EC+FF) = 10% AND 20%: EC/(EC+FF)= 10%

CID	NO. OF VEHICLES	MODE	CUT POINTS ST UNITS	CUT POINTS FTP UNITS	% CORRECT FAILURES	% EC	% EO	STE	STRR	EC/(EC+FF)	FTP AVG FOR ST PASS	FTP AVG FOR ST FAIL	CORRE-LATION
ALL	117	H		*****	PRACTICAL SOLUTION DOES NOT EXIST				*****				
	117	L		*****	PRACTICAL SOLUTION DOES NOT EXIST				*****				
	117	D		*****	PRACTICAL SOLUTION DOES NOT EXIST				*****				
	117	N		*****	PRACTICAL SOLUTION DOES NOT EXIST				*****				
		B		*****	NO MEANINGFUL SOLUTION				*****				
CID <= 150	33	H		*****	PRACTICAL SOLUTION DOES NOT EXIST				*****				
	33	L		*****	PRACTICAL SOLUTION DOES NOT EXIST				*****				
	33	D		*****	PRACTICAL SOLUTION DOES NOT EXIST				*****				
	33	N		*****	PRACTICAL SOLUTION DOES NOT EXIST				*****				
		B		*****	NO MEANINGFUL SOLUTION				*****				
150 TO 260	18	H		*****	PRACTICAL SOLUTION DOES NOT EXIST				*****				
	18	L		*****	PRACTICAL SOLUTION DOES NOT EXIST				*****				
	18	D		*****	PRACTICAL SOLUTION DOES NOT EXIST				*****				
	18	N		*****	PRACTICAL SOLUTION DOES NOT EXIST				*****				
		B		*****	NO MEANINGFUL SOLUTION				*****				
CID >= 260	66	H		*****	PRACTICAL SOLUTION DOES NOT EXIST				*****				
	66	L		*****	PRACTICAL SOLUTION DOES NOT EXIST				*****				
	66	D		*****	PRACTICAL SOLUTION DOES NOT EXIST				*****				
	66	N		*****	PRACTICAL SOLUTION DOES NOT EXIST				*****				
		B		*****	NO MEANINGFUL SOLUTION				*****				

TABLE 141

SUMMARY OF CONTINGENCY TABLE ANALYSIS-- CMP3-CONTINUED
GROUPED BY CID
FEDERAL SHORT CYCLE - 117 CAR FLEET (DENVER)
EC/(EC+FF) = 10% AND 20%: EC/(EC+FF)= 20%

CID	NO. OF VEHICLES	MODE	CUT POINTS ST UNITS	CUT POINTS FTP UNITS	% CORRECT FAILURES	% EC	% EO	STE	STRR	EC/(EC+FF)	FTP AVG FOR ST PASS	FTP AVG FOR ST FAIL	CORRELATION
ALL	117			***** PARAMETRIC SOLUTION DOES NOT EXIST *****									
CID <= 150	33			***** PARAMETRIC SOLUTION DOES NOT EXIST *****									
150 TO 260	18			***** PARAMETRIC SOLUTION DOES NOT EXIST *****									
CID >= 260	66			***** PARAMETRIC SOLUTION DOES NOT EXIST *****									

TABLE 142

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                         SUMMARY OF CONTINGENCY TABLE ANALYSIS-- CMP3-CONTINUED
                                 GROUPED BY       CID
                                 FEDERAL THREE-MODE - 117 CAR FLEET (DENVER)
                                 EC/(EC+FF) = 10%  AND 20%; EC/(EC+FF)=  20%

                 NO.    M                            %        %        %                                    FTP AVG
                  OF    O       CUT POINTS        CORRECT                                                   FOR ST          CORRE-
      CID       VEHICLES D  ST UNITS   FTP UNITS  FAILURES    EC       EO       STE     STRR  EC/(EC+FF)  PASS      FAIL    LATION
                         E

ALL               117   H              *****  PRACTICAL SOLUTION DOES NOT EXIST *****
                  117   L              *****  PRACTICAL SOLUTION DOES NOT EXIST *****
                  117   D              *****  PRACTICAL SOLUTION DOES NOT EXIST *****
                  117   N              *****  PRACTICAL SOLUTION DOES NOT EXIST *****
                        B              ****         NO MEANINGFUL SOLUTION      *****
CID <= 150         33   H              ***** PARAMETRIC SOLUTION DOES NOT EXIST *****
                   33   L              *****  PRACTICAL SOLUTION DOES NOT EXIST *****
                   33   D              *****  PRACTICAL SOLUTION DOES NOT EXIST *****
                   33   N              *****  PRACTICAL SOLUTION DOES NOT EXIST *****
                        B              *****        NO MEANINGFUL SOLUTION      *****
150 TO 260         18   H              ***** PARAMETRIC SOLUTION DOES NOT EXIST *****
                   18   L              *****  PRACTICAL SOLUTION DOES NOT EXIST *****
                   18   D              *****  PRACTICAL SOLUTION DOES NOT EXIST *****
                   18   N              *****  PRACTICAL SOLUTION DOES NOT EXIST *****
                        B              *****        NO MEANINGFUL SOLUTION      *****
CID >= 260         66   H              *****  PRACTICAL SOLUTION DOES NOT EXIST *****
                   66   L              *****  PRACTICAL SOLUTION DOES NOT EXIST *****
                   66   D              *****  PRACTICAL SOLUTION DOES NOT EXIST *****
                   66   N              *****  PRACTICAL SOLUTION DOES NOT EXIST *****
                        B              *****        NO MEANINGFUL SOLUTION      *****
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TABLE 143

SUMMARY OF CONTINGENCY TABLE ANALYSIS-- CMP3
GROUPED BY CID
FEDERAL SHORT CYCLE - 117 CAR FLEET (DENVER)
METHOD OF BOUNDED ERRORS OF COMMISSION: EC= 5%

CID	NO. OF VEHICLES	MODE	CUT POINTS ST UNITS	CUT POINTS FTP UNITS	% CORRECT FAILURES	% EC	% EO	STE	STRR	EC/(EC+FF)	FTP AVG FOR ST PASS	FTP AVG FOR ST FAIL	CORRE-LATION
ALL	117				88.89	5.98	2.56	0.97	1.04	0.06			0.3447
CID <= 150	33				84.85	0.00	9.09	0.90	0.90	0.00			0.6011
150 TO 260	18				77.78	5.56	5.56	0.93	1.00	0.07			0.6000
CID >= 260	66				92.42	6.06	0.00	1.00	1.07	0.06			0.4332

TABLE 144

SUMMARY OF CONTINGENCY TABLE ANALYSIS-- CMP3
GROUPED BY CID
FEDERAL THREE-MODE - 117 CAR FLEET (DENVER)
METHOD OF BOUNDED ERRORS OF COMMISSION; EC= 5%

CID	NO. OF VEHICLES	MODE	CUT POINTS ST UNITS	CUT POINTS FTP UNITS	% CORRECT FAILURES	% EC	% EO	STE	STRR	EC/(EC+FF)	FTP AVG FOR ST PASS	FTP AVG FOR ST FAIL	CORRE- LATION
ALL	117	H			85.47	0.85	5.98	0.93	0.94	0.01			0.6791
	117	L			82.05	0.85	9.40	0.90	0.91	0.01			0.5920
	117	D			76.07	3.42	15.38	0.83	0.87	0.04			0.2990
	117	N			74.36	1.71	17.09	0.81	0.83	0.02			0.4017
		B			81.20	0.85	10.26	0.89	0.90	0.01			0.5740
CID <= 150	33	H			63.64	0.00	30.30	0.68	0.68	0.00			0.3360
	33	L			66.67	0.00	27.27	0.71	0.71	0.00			0.3592
	33	D			81.82	3.03	12.12	0.87	0.90	0.04			0.2469
	33	N			78.79	3.03	15.15	0.84	0.87	0.04			0.2095
		B			75.76	0.00	18.18	0.81	0.81	0.00			0.4490
150 TO 260	18	H			50.00	0.00	33.33	0.60	0.60	0.00			0.4472
	18	L			61.11	5.56	22.22	0.73	0.80	0.08			0.3162
	18	D			55.56	11.11	27.78	0.67	0.80	0.17			0.0000
	18	N			61.11	5.56	22.22	0.73	0.80	0.08			0.3162
		B			50.00	0.00	33.33	0.60	0.60	0.00			0.4472
CID >= 260	66	H			80.30	0.00	12.12	0.87	0.37	0.00			0.5781
	66	L			77.27	0.00	15.15	0.84	0.84	0.00			0.5279
	66	D			60.61	1.52	31.82	0.66	0.67	0.02			0.2486
	66	N			92.42	7.58	0.00	1.00	1.08	0.08			INDEF
		B			83.33	0.00	9.09	0.90	0.90	0.00			0.6402

TABLE 145

SUMMARY OF CONTINGENCY TABLE ANALYSIS-- CMP3
GROUPED BY CID
FEDERAL SHORT CYCLE - 117 CAR FLEET (DENVER)
FIXED SHORT TEST EFFECTIVENESS: STE= 60%

CID	NO. OF VEHICLES	MODE	CUT POINTS ST UNITS	CUT POINTS FTP UNITS	% CORRECT FAILURES	% EC	% EO	STE	STRR	EC/(EC+FF)	FTP AVG FOR ST PASS	FTP AVG FOR ST FAIL	CORRELATION
ALL	117				70.09	0.00	21.37	0.77	0.77	0.00			0.4679
CID <= 150	33				69.70	0.00	24.24	0.74	0.74	0.00			0.3852
150 TO 260	18				55.56	0.00	27.78	0.67	0.67	0.00			0.5000
CID >= 260	66				72.73	0.00	19.70	0.79	0.79	0.00			0.4675

TABLE 146

SUMMARY OF CONTINGENCY TABLE ANALYSIS-- CMP3
GROUPED BY CID
FEDERAL THREE-MODE - 117 CAR FLEET (DENVER)
FIXED SHORT TEST EFFECTIVENESS: STE= 60%

CID	NO. OF VEHICLES	MODE	CUT POINTS ST UNITS	CUT POINTS FTP UNITS	% CORRECT FAILURES	% EC	% EO	STE	STRR	EC/(EC+FF)	FTP AVG FOR ST PASS	FTP AVG FOR ST FAIL	CORRELATION
ALL	117	H			78.63	0.85	12.82	0.86	0.87	0.01			0.5261
	117	L			76.92	0.00	14.53	0.84	0.84	0.00			0.5581
	117	D			81.20	5.98	10.26	0.89	0.95	0.07			0.1571
	117	N			76.07	4.27	15.38	0.83	0.88	0.05			0.2334
		B			63.25	0.00	28.21	0.69	0.69	0.00			0.4010
CID <= 150	33	H			69.70	0.00	24.24	0.74	0.74	0.00			0.3852
	33	L			69.70	0.00	24.24	0.74	0.74	0.00			0.3852
	33	D			84.85	3.03	9.09	0.90	0.94	0.03			0.2948
	33	N			75.76	3.03	18.18	0.81	0.84	0.04			0.1789
		B			75.76	0.00	18.18	0.81	0.81	0.00			0.4490
150 TO 260	18	H			61.11	5.56	22.22	0.73	0.80	0.08			0.3162
	18	L			61.11	5.56	22.22	0.73	0.80	0.08			0.3162
	18	D			66.67	11.11	16.67	0.80	0.93	0.14			0.1195
	18	N			55.56	5.56	27.78	0.67	0.73	0.09			0.2548
		B			55.56	0.00	27.78	0.67	0.67	0.00			0.5000
CID >= 260	66	H			63.64	0.00	28.79	0.69	0.69	0.00			0.3787
	66	L			62.12	0.00	30.30	0.67	0.67	0.00			0.3666
	66	D			77.27	4.55	15.15	0.84	0.89	0.06			0.1620
	66	N			84.85	4.55	7.58	0.92	0.97	0.05			0.2733
		B			56.06	0.00	36.36	0.61	0.61	0.00			0.3234

TABLE 147

SUMMARY OF CONTINGENCY TABLE ANALYSIS-- CMP3-CONTINUED
GROUPED BY CID
FEDERAL SHORT CYCLE - 117 CAR FLEET (DENVER)
FIXED SHORT TEST EFFECTIVENESS; STE= 70%

CID	NO. OF VEHICLES	MODE	CUT POINTS ST UNITS	CUT POINTS FTP UNITS	% CORRECT FAILURES	% EC	% EO	STE	STRR	EC/(EC+FF)	FTP AVG FOR ST PASS	FTP AVG FOR ST FAIL	CORRELATION
ALL	117				73.50	0.00	17.95	0.80	0.80	0.00			0.5092
CID <= 150	33				75.76	0.00	18.18	0.81	0.81	0.00			0.4490
150 TO 260	18				66.67	0.00	16.67	0.80	0.80	0.00			0.6325
CID >= 260	66				80.30	0.00	12.12	0.87	0.87	0.00			0.5781

TABLE 148

SUMMARY OF CONTINGENCY TABLE ANALYSIS-- CMP3-CONTINUED
GROUPED BY CID
FEDERAL THREE-MODE - 117 CAR FLEET (DENVER)
FIXED SHORT TEST EFFECTIVENESS; STE= 70%

CID	NO. OF VEHICLES	MODE	CUT POINTS ST UNITS	CUT POINTS FTP UNITS	% CORRECT FAILURES	% EC	% EO	STE	STRR	EC/(EC+FF)	FTP AVG FOR ST PASS	FTP AVG FOR ST FAIL	CORRELATION
ALL	117	H			79.49	2.56	11.97	0.87	0.90	0.03			0.4146
	117	L			80.34	1.71	11.11	0.88	0.90	0.02			0.4943
	117	D			84.62	5.98	6.84	0.93	0.99	0.07			0.2158
	117	N			82.05	5.13	9.40	0.90	0.95	0.06			0.2485
		B			71.79	0.00	19.66	0.79	0.79	0.00			0.4877
CID <= 150	33	H			81.82	0.00	12.12	0.87	0.87	0.00			0.5388
	33	L			72.73	0.00	21.21	0.77	0.77	0.00			0.4148
	33	D			84.85	3.03	9.09	0.90	0.94	0.03			0.2948
	33	N			78.79	3.03	15.15	0.84	0.87	0.04			0.2095
		B			75.76	0.00	18.18	0.81	0.81	0.00			0.4490
150 TO 260	18	H			72.22	5.56	11.11	0.87	0.93	0.07			0.4781
	18	L			66.67	5.56	16.67	0.80	0.87	0.08			0.3883
	18	D			66.67	11.11	16.67	0.80	0.93	0.14			0.1195
	18	N			61.11	11.11	22.22	0.73	0.87	0.15			0.0555
		B			66.67	0.00	16.67	0.80	0.80	0.00			0.6325
CID >= 260	66	H			65.15	1.52	27.27	0.70	0.72	0.02			0.2834
	66	L			71.21	3.03	21.21	0.77	0.80	0.04			0.2242
	66	D			84.85	6.06	7.58	0.92	0.98	0.07			0.1086
	66	N			89.39	7.58	3.03	0.97	1.05	0.08			-0.0506
		B			66.67	1.52	25.76	0.72	0.74	0.02			0.2962

TABLE 149

SUMMARY OF CONTINGENCY TABLE ANALYSIS-- CMP3-CONTINUED
GROUPED BY CID
FEDERAL SHORT CYCLE - 117 CAR FLEET (DENVER)
FIXED SHORT TEST EFFECTIVENESS; STE= 80%

CID	NO. OF VEHICLES	MODE	CUT POINTS		% CORRECT FAILURES	% EC	% EO	STE	STRR	EC/(EC+FF)	FTP AVG FOR ST		CORRE-LATION
			ST UNITS	FTP UNITS							PASS	FAIL	
ALL	117				82.05	1.71	9.40	0.90	0.92	0.02			0.5285
CID <= 150	33				81.82	0.00	12.12	0.87	0.87	0.00			0.5388
150 TO 260	18				72.22	5.56	11.11	0.87	0.93	0.07			0.4781
CID >= 260	66				84.85	1.52	7.58	0.92	0.93	0.02			0.5537

TABLE 150

SUMMARY OF CONTINGENCY TABLE ANALYSIS-- CMP3-CONTINUED
GROUPED BY CID
FEDERAL THREE-MODE - 117 CAR FLEET (DENVER)
FIXED SHORT TEST EFFECTIVENESS: STE= 80%

CID	NO. OF VEHICLES	MODE	CUT POINTS ST UNITS	CUT POINTS FTP UNITS	% CORRECT FAILURES	% EC	% EO	STE	STRR	EC/(EC+FF)	FTP AVG FOR ST PASS	FTP AVG FOR ST FAIL	CORRELATION
ALL	117	H			86.32	3.42	5.13	0.94	0.98	0.04			0.5012
	117	L			83.76	2.56	7.69	0.92	0.94	0.03			0.5012
	117	D			86.32	6.84	5.13	0.94	1.02	0.07			0.1594
	117	N			87.18	7.69	4.27	0.95	1.04	0.08			0.0675
		B			77.78	1.71	13.68	0.85	0.87	0.02			0.4504
CID <= 150	33	H			84.85	0.00	9.09	0.90	0.90	0.00			0.6011
	33	L			75.76	0.00	18.18	0.81	0.81	0.00			0.4490
	33	D			84.85	3.03	9.09	0.90	0.94	0.03			0.2948
	33	N			84.85	3.03	9.09	0.90	0.94	0.03			0.2948
		B			81.82	0.00	12.12	0.87	0.87	0.00			0.5388
150 TO 260	18	H			83.33	5.56	0.00	1.00	1.07	0.06			0.7906
	18	L			72.22	5.56	11.11	0.87	0.93	0.07			0.4781
	18	D			66.67	11.11	16.67	0.80	0.93	0.14			0.1195
	18	N			66.67	11.11	16.67	0.80	0.93	0.14			0.1195
		B			66.67	5.56	16.67	0.80	0.87	0.08			0.3883
CID >= 260	66	H			78.79	4.55	13.64	0.85	0.90	0.05			0.1793
	66	L			80.30	4.55	12.12	0.87	0.92	0.05			0.1984
	66	D			87.88	7.58	4.55	0.95	1.03	0.08			-0.0625
	66	N			90.91	7.58	1.52	0.98	1.07	0.08			-0.0355
		B			72.73	3.03	19.70	0.79	0.82	0.04			0.2389

TABLE 151

FEDERAL SHORT CYCLE CUT-POINTS FOR THE 117 CAR FLEET

ST Cut-Point Selection Technique	ST Cut-Point in Grams/Mile		
	HC	CO	NOx
STRR = 1.0	0.86	4.06	2.95
EC/(EC+FF) = 10%	0.98	--	4.65
= 20%	0.61	--	3.89
EC = 5%	1.06	3.28	2.54
STE = 0.60	1.43	15.98	2.90
= 0.70	1.22	12.18	2.64
= 0.80	1.01	8.95	2.38

TABLE 152
FEDERAL THREE-MODE
CUT-POINTS FOR 117 CAR FLEET

ST Cut-Point Selection Technique	ST Cut-Points in PPM		
	HC Idle in Dr.	CO Idle in Dr.	NO_x High Speed
STRR = 1.0	75	605	2442
EC/(EC+FF) = 10%	238	--	--
= 20%	82	--	--
EC = 5%	168	984	2227
STE = 0.60	128	6443	1693
= 0.70	98	3840	1453
= 0.80	73	2103	1215

TABLE 153

FEDERAL SHORT CYCLE

TECHNIQUE RANKS FOR THE 117 CAR FLEET

ST Cut-Point Selection Technique	Technique Ranks		
	HC	CO	NOx
STRR = 1.0	6	4	3
EC/(EC+FF) = 10%	5	-	1
= 20%	7	-	2
EC = 5%	3	5	6
STE = 0.60	1	1	4
= 0.70	2	2	5
= 0.80	4	3	7

TABLE 154
FEDERAL THREE-MODE
TECHNIQUE RANKS FOR THE 117 CAR FLEET

ST Cut-Point Selection Technique	Technique Ranks		
	HC Idle in Dr.	CO Idle in Dr.	NOx High Speed
STRR = 1.0	6	5	1
EC/(EC+FF) = 10%	1	-	-
= 20%	5	-	-
EC = 5%	2	4	2
STE = 0.60	3	1	3
= 0.70	4	2	4
= 0.80	7	3	5

TABLE 155
INITIAL SIMULATED FLEET STATISTICS[(a)]; 300 CARS

CID[(b)]	No. of Vehicles	Average Emissions Grams/Mile					
		HC		CO		NO_x	
		Mean	SE[(c)]	Mean	SE	Mean	SE
Less than 150	951	1.89	.837	23.2	11.21	2.12	1.051
151 to 259	540	1.88	.796	29.8	19.46	2.42	.902
Greater than 260	1509	1.97	.950	34.7	28.13	2.56	1.051

(a) After initial correction to 17,500 miles

(b) CID = cubic inch displacement

(c) SE = standard error

TABLE 156

207(b) ST CUT-POINTS FOR EACH ENGINE FAMILY; FEDERAL SHORT CYCLE; STRR= 1. 0; 300 CARS

CID[(a)]	Cut-Points in Grams/Mile		
	HC	CO	NO_x
150 and Less	1. 03	8. 9	2. 33
151 to 259	0. 96	4. 47	2. 50
260 and Greater	1. 07	3. 75	2. 49

(a) CID - Cubic Inch Displacement

TABLE 157

FTP VALUES EQUIVALENT TO 207(b) ST CUT-POINTS; FEDERAL SHORT CYCLE; STRR= 1. 0; 300 CARS

CID	Equivalent ST Cut-Points - Grams/Mile		
	HC	CO	NO_x
150 and Less	1. 50	15. 0	3. 10
151 to 259	1. 50	15. 0	3. 10
260 and Greater	1. 50	15. 0	3. 10

TABLE 158

207(b) ST CUT-POINTS FOR EACH ENGINE FAMILY; FEDERAL THREE-MODE[a]; STRR= 1.0; 300 CARS

CID[b]	Cut-Point in PPM		
	HC	CO	NO_x
150 and Less	124	5907	2475
151 to 259	138	2446	1155
260 and Greater	97	1121	1589

[a] The ST was defined from the Federal Three-Mode with HC and CO idle in drive, and NOx in high speed (low speed NOx was used for 151 to 259 CID group)

[b] CID - Cubic Inch Displacement

TABLE 159

FTP VALUES EQUIVALENT TO 207(b) ST CUT-POINTS; FEDERAL THREE-MODE; STRR= 1.0; 300 CARS

CID	Equivalent ST Cut-Points - Grams/Mile		
	HC	CO	NO_x
150 and Less	1.50	15.0	3.10
151 to 259	1.50	15.0	3.10
260 and Greater	1.50	15.0	3.10

TABLE 160

207(b) PROGRAM EFFICIENCIES FOR THE FEDERAL SHORT CYCLE; 300 CAR FLEET; STRR=1.0

Maintenance		Number of Years Since 1st Inspection	Estimated Cumulative Program Efficiencies in Percent					
			Over Fleet Life			Over Program Life		
Version	Period of Effectiveness		HC	CO	NOx	HC	CO	NOx
1	12	1	17.50	24.97	.54	28.37	41.08	1.11
		2	29.64	36.46	.50	38.22	47.85	.80
		3(a)	32.84	40.28	.65	41.11	51.31	1.00
	9	1	15.15	20.27	.09	24.56	33.35	.18
		2	25.26	30.17	-.07	32.58	39.59	-.11
		3(a)	28.55	34.42	.11	35.73	43.84	.16
	6	1	11.35	14.50	-.36	18.40	23.85	-.75
		2	18.82	21.83	-.66	24.27	28.66	-1.04
		3(a)	22.21	26.21	-.49	27.80	33.3[illegible]	-.74
2	12	1	17.50	21.31	.54	28.37	35.06	1.11
		2	29.64	32.06	.50	38.22	42.08	.80
		3(a)	32.84	35.41	.65	41.11	45.10	1.00
	9	1	15.15	17.53	.09	24.56	28.83	.18
		2	25.26	26.52	-.07	32.58	34.81	-.11
		3(a)	28.55	30.08	.11	35.73	38.31	.16
	6	1	11.35	12.67	-.36	18.40	20.84	-.75
		2	18.82	19.29	-.66	24.27	25.31	-1.04
		3(a)	22.21	22.94	-.49	27.80	29.22	-.74
3	12	1	17.50	21.31	.54	28.37	35.06	1.11
		2	29.64	32.06	.50	38.22	42.08	.80
		3(a)	32.84	35.41	.65	41.11	45.10	1.00
	9	1	15.15	17.53	.09	24.56	28.83	.18
		2	25.26	26.52	-.07	32.58	34.81	-.11
		3(a)	28.55	30.08	-.11	35.73	38.31	.16
	6	1	11.35	12.67	-.36	18.40	20.84	-.75
		2	18.82	19.29	-.66	24.27	25.31	-1.04
		3(a)	22.21	22.94	-.49	27.80	29.22	-.74

(a) Not a full year. Program ended at 50,000 miles.

TABLE 161

207(b) PROGRAM EFFICIENCIES FOR THE FEDERAL THREE-MODE; 300 CAR FLEET; STRR=1.0

Maintenance		Number of Years Since 1st Inspection	Estimated Cumulative Program Efficiencies in Percent					
			Over Fleet Life			Over Program Life		
Version	Period of Effectiveness		HC	CO	NOx	HC	CO	NOx
1	12	1	16.84	24.17	.43	27.30	39.76	.89
		2	28.75	35.46	.42	37.08	46.55	.67
		3(a)	31.97	39.28	.56	40.00	50.03	.86
	9	1	14.57	19.60	0.0	23.61	32.25	-.01
		2	24.45	29.26	-.13	31.52	38.41	-.21
		3(a)	27.74	33.51	.03	34.72	42.68	.05
	6	1	10.90	14.00	-.44	17.66	23.03	-.90
		2	18.18	21.16	-.70	23.45	27.77	-1.11
		3(a)	21.56	25.50	-.53	26.98	32.48	-.82
2	12	1	16.84	20.64	.43	27.30	33.95	.89
		2	28.75	31.17	.42	37.08	40.91	.67
		3(a)	31.97	34.51	.56	40.00	43.95	.86
	9	1	14.57	16.95	0.0	23.61	27.89	-.01
		2	24.45	25.73	-.13	31.52	33.77	-.21
		3(a)	27.74	29.29	.03	34.72	37.31	.05
	6	1	10.90	12.23	-.44	17.66	20.12	-.90
		2	18.18	18.69	-.70	23.45	24.53	-1.11
		3(a)	21.56	22.33	-.53	26.98	28.44	-.82
3	12	1	16.84	20.64	.43	27.30	33.95	.89
		2	28.75	31.17	.42	37.08	40.91	.67
		3(a)	31.97	34.51	.56	40.00	43.95	.86
	9	1	14.57	16.95	0.0	23.61	27.89	-.01
		2	24.45	25.73	-.13	31.52	33.77	-.21
		3(a)	27.74	29.29	.03	34.72	37.31	.05
	6	1	10.90	12.23	-.44	17.66	20.12	-.90
		2	18.18	18.69	-.70	23.45	24.53	-1.11
		3(a)	21.56	22.33	-.53	26.98	28.44	-.82

(a) Not a full year. Program ended at 50,000 miles.

TABLE 162

207(b) ST CUT-POINTS FOR EACH ENGINE FAMILY; FEDERAL SHORT CYCLE; EC=5%; 300 CARS

CID[a]	Cut-Points in Grams/Mile		
	HC	CO	NO_x
150 and Less	1.28	13.1	2.37
151 to 259	1.27	6.24	2.62
260 and Greater	1.35	5.61	2.78

(a) CID - Cubic Inch Displacement

TABLE 163

FTP VALUES EQUIVALENT TO 207(b) ST CUT-POINTS; FEDERAL SHORT CYCLE; EC=5%; 300 CARS

CID	Equivalent ST Cut-Points - Grams/Mile		
	HC	CO	NO_x
150 and Less	1.50	17.45	3.100
151 to 259	1.67	16.07	3.100
260 and Greater	1.71	15.0	3.27

TABLE 164

207(b) ST CUT-POINTS FOR EACH ENGINE FAMILY; FEDERAL THREE-MODE[a]; EC=5%; 300 CARS

CID[b]	Cut-Point in PPM		
	HC	CO	NO_x
150 and Less	219	18, 332	2. 806
151 to 259	213	7, 063	1, 396
260 and Greater	151	2, 655	1, 986

[a] The ST was defined from the Federal Three-Mode with HC and CO idle in drive, and NOx in high speed (low speed NOx was used for 151 to 259 CID group)

[b] CID - Cubic Inch Displacement

TABLE 165

FTP VALUES EQUIVALENT TO 207(b) ST CUT-POINTS FEDERAL THREE-MODE; EC=5%; 300 CARS

CID	Equivalent ST Cut-Points - Grams/Mile		
	HC	CO	NO_x
150 and Less	1. 58	18. 08	3. 10
151 to 259	1. 63	16. 66	3. 10
260 and Greater	1. 80	15. 0	3. 26

TABLE 166

207(b) PROGRAM EFFICIENCIES FOR THE FEDERAL SHORT CYCLE; 300 CAR FLEET; EC=5%

Maintenance		Number of Years Since 1st Inspection	Estimated Cumulative Program Efficiencies in Percent					
			Over Fleet Life			Over Program Life		
Version	Period of Effectiveness		HC	CO	NOx	HC	CO	NOx
1	12	1	16.21	23.33	.97	26.27	38.39	2.00
		2	27.83	34.51	1.10	35.89	45.29	1.75
		3[a]	31.07	38.39	1.26	38.88	48.89	1.93
	9	1	14.00	18.90	.54	22.70	31.10	1.11
		2	23.67	28.42	.55	30.52	37.30	.88
		3[a]	27.00	32.71	.75	33.80	41.66	1.14
	6	1	10.51	13.51	.11	17.04	22.22	.23
		2	17.69	20.59	0.0	22.81	27.02	0.0
		3[a]	21.09	24.95	.19	26.40	31.78	.29
2	12	1	16.21	19.97	.97	26.27	32.85	2.00
		2	27.83	30.34	1.10	35.89	39.82	1.75
		3[a]	31.07	33.72	1.26	38.88	42.95	1.93
	9	1	14.00	16.38	.54	22.70	26.94	1.11
		2	23.67	25.04	.55	30.52	32.86	.88
		3[a]	27.00	28.64	.75	33.80	36.48	1.14
	6	1	10.51	11.82	.11	17.04	19.45	.23
		2	17.69	18.23	0.0	22.81	23.92	0.0
		3[a]	21.09	21.89	.19	26.40	27.88	.29
3	12	1	15.33	19.49	.80	24.85	32.06	1.66
		2	26.80	29.77	.88	34.55	39.07	1.40
		3[a]	29.92	33.02	1.02	37.44	42.13	1.56
	9	1	13.34	16.02	.41	21.63	26.36	.86
		2	22.82	24.58	.38	29.43	32.27	.61
		3[a]	25.99	28.10	.55	32.53	35.53	.84
	6	1	10.07	11.59	.03	16.33	19.06	.06
		2	17.09	17.91	-.11	22.03	23.51	-.18
		3[a]	20.32	21.49	.05	25.43	27.37	.07

[a] Not a full year. Program ended at 50,000 miles.

TABLE 167

207(b) PROGRAM EFFICIENCIES FOR THE FEDERAL THREE-MODE; 300 CAR FLEET; EC=5%

Maintenance		Number of Years Since 1st Inspection	Estimated Cumulative Program Efficiencies in Percent					
Version	Period of Effectiveness		Over Fleet Life			Over Program Life		
			HC	CO	NOx	HC	CO	NOx
1	12	1	13.97	20.59	.86	22.65	33.88	1.79
		2	24.63	30.95	1.06	31.76	40.62	1.68
		3[a]	27.85	34.76	1.22	34.85	44.27	1.87
	9	1	12.03	16.62	.49	19.50	27.35	1.01
		2	20.80	25.32	.59	26.82	33.23	.93
		3[a]	24.09	29.47	.78	30.15	37.54	1.20
	6	1	8.99	11.84	.11	14.58	19.47	.23
		2	15.45	18.24	.08	19.92	23.95	.13
		3[a]	18.75	22.44	.28	23.47	28.58	.43
2	12	1	13.97	17.68	.86	22.65	29.09	1.79
		2	24.63	27.25	1.06	31.76	35.77	1.68
		3[a]	27.85	30.57	1.22	34.85	38.93	1.87
	9	1	12.03	14.44	.49	19.50	23.76	1.01
		2	20.80	22.34	.59	26.82	29.32	.93
		3[a]	24.09	25.86	.78	30.15	32.94	1.20
	6	1	8.99	10.38	.11	14.58	17.08	.23
		2	15.45	16.18	.08	19.92	21.23	.13
		3[a]	18.75	19.73	.28	23.47	25.13	.43
3	12	1	12.86	17.21	.73	20.84	28.32	1.50
		2	23.26	26.66	.87	29.99	34.98	1.38
		3[a]	26.31	29.89	1.01	32.92	38.07	1.55
	9	1	11.19	14.09	.38	18.15	23.18	.79
		2	19.69	21.87	.44	25.39	28.71	.70
		3[a]	22.75	25.29	.61	28.47	32.21	.93
	6	1	8.44	10.15	.04	13.68	16.70	.08
		2	14.66	15.86	-.02	18.90	20.81	-.03
		3[a]	17.72	19.30	.15	22.18	24.59	.23

[a] Not a full year. Program ended at 50,000 miles.

TABLE 168

207(b) ST CUT-POINTS FOR EACH ENGINE FAMILY; FEDERAL SHORT CYCLE; STE=0.60; 300 CARS

CID[a]	Cut-Points in Grams/Mile		
	HC	CO	NO_x
150 and Less	1.27	12.27	2.44
151 to 259	1.04	9.10	2.68
260 and Greater	1.4	11.08	2.62

(a) CID - Cubic Inch Displacement

TABLE 169

FTP VALUES EQUIVALENT TO 207(b) ST CUT-POINTS; FEDERAL SHORT CYCLE; STE=0.6; 300 CARS

CID	Equivalent ST Cut-Points - Grams/Mile		
	HC	CO	NO_x
150 and Less	1.50	16.97	3.11
151 to 259	1.50	18.72	3.10
260 and Greater	1.77	21.13	3.13

TABLE 170

207(b) ST CUT-POINTS FOR EACH ENGINE FAMILY; FEDERAL THREE-MODE[a]; STE=0.6; 300 CARS

CID[b]	Cut-Point in PPM		
	HC	CO	NO_x
150 and Less	115	8365	2200
151 to 259	120	6066	1100
260 and Greater	107	4642	1476

[a] The ST was defined from the Federal Three-Mode with HC and CO idle in drive, and NOx in high speed (low speed NOx was used for 151 to 259 CID group)

[b] CID - Cubic Inch Displacement

TABLE 171

FTP VALUES EQUIVALENT TO 207(b) ST CUT-POINTS; FEDERAL THREE-MODE; STE=0.6; 300 CARS

CID	Equivalent ST Cut-Points - Grams/Mile		
	HC	CO	NO_x
150 and Less	1.50	15.0	3.10
151 to 259	1.50	16.43	3.10
260 and Greater	1.50	17.31	3.10

TABLE 172

207(b) PROGRAM EFFICIENCIES FOR THE FEDERAL SHORT CYCLE; 300 CAR FLEET; STE=0.6

Maintenance		Number of Years Since 1st Inspection	Estimated Cumulative Program Efficiencies in Percent					
			Over Fleet Life			Over Program Life		
Version	Period of Effectiveness		HC	CO	NOx	HC	CO	NOx
1	12	1	15.64	22.50	1.01	25.35	37.02	2.09
		2	26.98	33.42	1.20	34.78	43.86	1.91
		3(a)	30.21	37.27	1.38	37.81	47.47	2.11
	9	1	13.49	18.21	.59	21.87	29.96	1.21
		2	22.91	27.49	.66	29.54	36.08	1.04
		3(a)	26.24	31.73	.86	32.84	40.42	1.31
	6	1	10.12	13.01	.16	16.41	21.40	.33
		2	17.12	19.93	.10	22.08	26.15	.16
		3(a)	20.51	24.26	.30	25.67	30.90	.46
2	12	1	15.64	19.26	1.01	25.35	31.69	2.09
		2	26.98	29.37	1.20	34.78	38.55	1.91
		3(a)	30.21	32.73	1.38	37.81	41.69	2.11
	9	1	13.49	15.78	.59	21.87	25.96	1.21
		2	22.91	24.22	.66	29.54	31.79	1.04
		3(a)	26.24	27.80	.86	32.84	35.40	1.31
	6	1	10.12	11.38	.16	16.41	18.73	.33
		2	17.12	17.64	.10	22.80	23.15	.16
		3(a)	20.51	21.29	.30	25.67	27.11	.46
3	12	1	14.84	17.19	.98	24.05	28.28	2.02
		2	26.01	26.89	1.15	33.53	35.29	1.83
		3(a)	29.13	29.98	1.32	36.46	38.18	2.03
	9	1	12.89	14.23	.56	20.90	23.41	1.16
		2	22.13	22.28	.62	28.53	29.24	.99
		3(a)	25.30	25.50	.82	31.67	32.48	1.25
	6	1	9.72	10.35	.14	15.76	17.02	.30
		2	16.57	16.29	.08	21.36	21.38	.12
		3(a)	19.79	19.55	.27	24.77	24.91	.41

(a) Not a full year. Program ended at 50,000 miles.

TABLE 173

207(b) PROGRAM EFFICIENCIES FOR THE FEDERAL THREE-MODE; 300 CAR FLEET; STE=0.6

Maintenance		Number of Years Since 1st Inspection	Estimated Cumulative Program Efficiencies in Percent					
			Over Fleet Life			Over Program Life		
Version	Period of Effectiveness		HC	CO	NOx	HC	CO	NOx
1	12	1	15.64	22.53	.54	25.35	37.07	1.12
		2	27.08	33.50	.60	34.91	43.97	.95
		3(a)	30.31	37.34	.74	37.93	47.55	1.13
	9	1	13.49	18.25	.12	21.87	30.02	.26
		2	22.93	27.51	.06	29.57	36.11	.09
		3(a)	26.23	31.72	.23	32.83	40.40	.36
	6	1	10.09	13.02	-.29	16.35	21.41	-.60
		2	17.04	19.87	-.49	21.97	26.08	-.78
		3(a)	20.40	24.16	-.32	25.53	30.78	-.49
2	12	1	15.64	19.26	.54	25.35	31.68	1.12
		2	27.08	29.42	.60	34.91	38.62	.95
		3(a)	30.31	32.76	.74	37.93	41.73	1.13
	9	1	13.49	15.79	.12	21.87	25.98	.26
		2	22.93	24.20	.06	29.57	31.77	.09
		3(a)	26.23	27.74	.23	32.83	35.34	.36
	6	1	10.09	11.38	-.29	16.35	18.72	-.60
		2	17.04	17.57	-.49	21.97	23.05	-.78
		3(a)	20.40	21.17	-.32	25.53	26.97	-.49
3	12	1	15.64	18.52	.54	25.35	40.47	1.12
		2	27.08	28.56	.60	34.91	37.48	.95
		3(a)	30.31	31.81	.74	37.93	40.51	1.13
	9	1	13.49	15.24	.12	21.87	25.07	.26
		2	22.93	23.53	.06	29.57	30.88	.09
		3(a)	26.33	26.95	.23	32.83	34.83	.36
	6	1	10.09	11.01	-.29	16.35	18.12	-.60
		2	17.04	17.10	-.49	21.97	22.45	-.78
		3(a)	20.40	20.59	-.32	25.53	26.22	-.49

(a) Not a full year. Program ended at 50,000 miles.

TABLE 174

207(b) ST CUT-POINTS FOR EACH ENGINE FAMILY; FEDERAL SHORT CYCLE; STE=0.7; 300 CARS

CID[a]	Cut-Points in Grams/Mile		
	HC	CO	NO_x
150 and Less	1.07	9.95	2.20
151 to 259	.85	6.96	2.46
260 and Greater	1.15	7.59	2.38

(a) CID - Cubic Inch Displacement

TABLE 175

FTP VALUES EQUIVALENT TO 207(b) ST CUT-POINTS; FEDERAL SHORT CYCLE; STE=0.7; 300 CARS

CID	Equivalent ST Cut-Points - Grams/Mile		
	HC	CO	NO_x
150 and Less	1.50	15.60	3.10
151 to 259	1.50	16.74	3.10
260 and Greater	1.51	17.08	3.10

TABLE 176

207(b) ST CUT-POINTS FOR EACH ENGINE FAMILY; FEDERAL SHORT CYCLE; STE=0.8; 300 CARS

CID[a]	Cut-Points in Grams/Mile		
	HC	CO	NO_x
150 and Less	.88	7.82	1.94
151 to 259	.68	5.14	2.22
260 and Greater	.93	4.97	2.13

[a] CID - Cubic Inch Displacement

TABLE 177

FTP VALUES EQUIVALENT TO 207(b) ST CUT-POINTS; FEDERAL SHORT CYCLE; STE=0.8; 300 CARS

CID	Equivalent ST Cut-Points - Grams/Mile		
	HC	CO	NO_x
150 and Less	1.50	15.00	3.10
151 to 259	1.50	15.00	3.10
260 and Greater	1.50	15.00	3.10

TABLE 178

207(b) ST CUT-POINTS FOR EACH ENGINE FAMILY; FEDERAL THREE-MODE[a]; STE=0.7; 300 CARS

CID[b]	Cut-Point in PPM		
	HC	CO	NO_x
150 and Less	90	5369	1909
151 to 259	98	4107	935
260 and Greater	85	2690	1308

[a] The ST was defined from the Federal Three-Mode with HC and CO idle in drive, and NOx in high speed (low speed NOx was used for 151 to 259 CID group)

[b] CID - Cubic Inch Displacement

TABLE 179

FTP VALUES EQUIVALENT TO 207(b) ST CUT-POINTS; FEDERAL THREE-MODE; STE=0.7; 300 CARS

CID	Equivalent ST Cut-Points - Grams/Mile		
	HC	CO	NO_x
150 and Less	1.50	15.00	3.10
151 to 259	1.50	15.14	3.10
260 and Greater	1.50	15.00	3.10

TABLE 180

207(b) ST CUT-POINTS FOR EACH ENGINE FAMILY; FEDERAL THREE-MODE[a]; STE=0.8; 300 CARS

CID[b]	Cut-Point in PPM		
	HC	CO	NO_x
150 and Less	68	3206	1616
151 to 259	77	2372	775
260 and Greater	65	1443	1136

[a] The ST was defined from the Federal Three-Mode with HC and CO idle in drive, and NOx in high speed (low speed NOx was used for 151 to 259 CID group)

[b] CID - Cubic Inch Displacement

TABLE 181

FTP VALUES EQUIVALENT TO 207(b) ST CUT-POINTS; FEDERAL THREE MODE; STE=0.8; 300 CARS

CID	Equivalent ST Cut-Points - Grams/Mile		
	HC	CO	NO_x
150 and Less	1.50	15.00	3.10
151 to 259	1.50	15.00	3.10
260 and Greater	1.50	15.00	3.10

TABLE 182

207(b) PROGRAM EFFICIENCIES FOR 300 CAR FLEET; VERSION 3; 12 MONTH PERIOD OF MAINTENANCE EFFECTIVENESS

Short Test	Cut-Point Selection Technique	Number of Years Since 1st Inspection	Estimated Cumulative Program Efficiencies in Percent					
			Over Fleet Life			Over Program Life		
			HC	CO	NOx	HC	CO	NOx
Federal Short Cycle	STE=0.6	1	14.84	17.19	.98	24.05	28.28	2.02
		2	26.01	26.89	1.15	33.53	35.29	1.83
		3[a]	29.13	29.98	1.32	36.46	38.18	2.03
	STE=0.7	1	16.83	19.68	.76	27.28	32.37	1.58
		2	28.71	30.10	.86	37.01	39.50	1.36
		3[a]	31.92	33.35	1.03	39.95	42.48	1.57
	STE =0.8	1	17.75	21.52	.37	28.77	35.40	.77
		2	30.15	32.47	.34	38.88	42.62	.55
		3[a]	33.34	35.81	.49	41.73	45.61	.76
Federal Three-Mode	STE=0.6	1	15.64	18.52	.54	25.35	30.47	1.12
		2	27.08	28.56	.60	34.91	37.48	.95
		3[a]	30.31	31.81	.74	37.93	40.51	1.13
	STE=0.7	1	16.79	20.48	.36	27.21	33.70	.74
		2	28.80	31.10	.33	37.14	40.82	.52
		3[a]	32.02	34.45	.48	40.08	43.88	.73
	STE=0.8	1	17.72	21.49	.06	28.73	35.35	.13
		2	30.21	32.50	-.04	38.96	42.66	-.06
		3[a]	33.41	35.84	.11	41.82	45.64	.17

[a] Not a full year. Program ended at 50,000 miles.

TABLE 183
I/M ST CUT-POINTS FOR EACH SELECTION TECHNIQUE
FEDERAL SHORT CYCLE; 300 CARS

Cut-Point Selection Technique	Cut-Points in Grams/Mile		
	HC	CO	NO_x
STRR=1.0	1.04	5.17	2.45
EC=5%	1.32	8.40	2.62
STE=0.6	1.29	11.25	2.63

TABLE 184
FTP VALUES EQUIVALENT TO I/M ST CUT-POINTS;
FEDERAL SHORT CYCLE; 300 CARS

Cut-Point Selection Technique	Equivalent ST Cut-Points - Grams/Mile		
	HC	CO	NO_x
STRR=1.0	1.50	15.00	3.10
EC=5%	1.64	16.71	3.14
STE=0.6	1.62	19.97	3.15

TABLE 185

I/M ST CUT-POINTS FOR EACH SELECTION TECHNIQUE FEDERAL THREE-MODE[a]; 300 CARS

Cut-Point Selection Technique	Cut-Point in PPM		
	HC	CO	NO_x
STRR= 1.0	112	2198	1803
EC= 5%	184	7081	2265
STE= 0.6	112	5867	1558

[a] The ST was defined from the Federal Three-Mode with HC and CO idle in drive, and NOx in high speed

TABLE 186

FTP VALUES EQUIVALENT TO I/M ST CUT-POINTS; FEDERAL THREE-MODE; 300 CARS

Cut-Point Selection Technique	Equivalent ST Cut-Points - Grams/Mile		
	HC	CO	NO_x
STRR= 1.0	1.50	15.00	3.10
EC= 5%	1.69	17.83	3.10
STE= 0.6	1.50	16.88	3.10

TABLE 187

I/M PROGRAM EFFICIENCIES FOR 300 CAR FLEET; VERSION 3; 12 MONTH PERIOD OF MAINTENANCE EFFECTIVENESS

Short Test	Cut-Point Selection Technique	Number of Years Since 1st Inspection	Estimated Cumulative Program Efficiencies in Percent					
			Over Fleet Life			Over Program Life		
			HC	CO	NOx	HC	CO	NOx
Federal Short Cycle	STRR=1.0	1	17.67	21.42	.47	28.64	35.24	.97
		2	29.96	32.29	.42	38.63	42.38	.67
		3(a)	33.14	35.63	.56	41.48	45.38	.86
	EC=5%	1	15.31	18.97	.68	24.82	31.22	1,41
		2	26.75	29.16	.79	34.49	38.27	1.25
		3(a)	29.86	32.41	.94	37.36	41.28	1.44
	STE=0.6	1	14.79	16.86	.91	23.97	27.73	1.88
		2	25.97	26.52	1.07	33.49	34.81	1.69
		3(a)	29.11	29.58	1.23	36.43	37.67	1.88
Federal Three-Mode	STRR=1.0	1	16.69	20.38	.23	27.06	33.53	.47
		2	28.69	31.04	.16	36.99	40.74	.25
		3(a)	31.90	34.38	.30	39.92	43.79	.45
	EC=5%	1	12.85	16.12	.65	20.83	26.31	1.35
		2	22.91	24.99	.81	29.55	32.80	1.28
		3(a)	25.96	28.11	.97	32.48	35.81	1.49
	STE=0.6	1	15.76	18.37	.46	25.54	30.22	.95
		2	27.19	28.31	.49	35.06	37.15	.78
		3(a)	30.41	31.51	.63	38.06	40.14	.96

(a) Not a full year. Program ended at 50,000 miles.

TABLE 188

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TABLE 189
INITIAL SIMULATED FLEET STATISTICS[a]; 117 CARS

CID[b]	No. of Vehicles	Average Emissions Grams/Mile HC Mean	HC SE[c]	CO Mean	CO SE	NO_x Mean	NO_x SE
Less than 150	951	2.76	1.11	42.5	22.40	1.59	.804
151 to 259	540	2.48	1.08	44.1	25.43	1.91	.970
Greater than 260	1509	2.95	1.35	63.5	38.19	1.69	.743

[a] After initial correction to 17,500 miles

[b] CID = cubic inch displacement

[c] SE = standard error

TABLE 190

207(b) ST CUT-POINTS FOR EACH ENGINE FAMILY; FEDERAL SHORT CYCLE; STRR= 1.0; 117 CARS

CID[a]	Cut-Points in Grams/Mile		
	HC	CO	NO_x
150 and Less	0.76	5.62	2.56
151 to 259	0.79	2.98	3.26
260 and Greater	0.94	3.70	3.04

(a) CID - Cubic Inch Displacement

TABLE 191

FTP VALUES EQUIVALENT TO 207(b) ST CUT-POINTS; FEDERAL SHORT CYCLE; STRR= 1.0; 117 CARS

CID	Equivalent ST Cut-Points - Grams/Mile		
	HC	CO	NO_x
150 and Less	1.86	22.2	3.10
151 to 259	1.67	25.4	3.10
260 and Greater	1.54	25.1	3.10

TABLE 192
207(b) ST CUT-POINTS FOR EACH ENGINE FAMILY; FEDERAL THREE-MODE(a); STRR= 1.0; 117 CARS

CID(b)	Cut-Point in PPM		
	HC	CO	NO_x
150 and Less	62	1933	3089
151 to 259	182	498	1617
260 and Greater	73	311	2168

(a) The ST was defined from the Federal Three-Mode with HC and CO idle in drive, and NOx in high speed (low speed NOx was used for 151 to 259 CID group)

(b) CID - Cubic Inch Displacement

TABLE 193
FTP VALUES EQUIVALENT TO 207(b) ST CUT-POINTS; FEDERAL THREE-MODE; STRR= 1.0; 117 CARS

CID	Equivalent ST Cut-Points - Grams/Mile		
	HC	CO	NO_x
150 and Less	2.16	22.44	3.10
151 to 259	1.82	24.68	3.10
260 and Greater	1.64	32.47	3.59

TABLE 194

207(b) PROGRAM EFFICIENCIES FOR THE FEDERAL SHORT CYCLE; 117 CAR FLEET; STRR=1.0

Maintenance		Number of Years Since 1st Inspection	Estimated Cumulative Program Efficiencies in Percent					
			Over Fleet Life			Over Program Life		
Version	Period of Effectiveness		HC	CO	NOx	HC	CO	NOx
1	12	1	21.97	28.68	.50	36.20	48.27	1.11
		2	33.47	38.95	.66	43.92	52.38	1.10
		3(a)	36.70	42.71	.75	46.72	55.73	1.20
	9	1	18.38	22.69	.35	30.29	38.18	.77
		2	27.97	31.17	.46	36.70	41.92	.76
		3(a)	31.41	35.40	.55	39.99	46.07	.88
	6	1	13.52	15.91	.20	22.28	26.77	.43
		2	20.57	22.04	.26	26.99	29.64	.42
		3(a)	24.12	26.25	.35	30.71	34.26	.55
2	12	1	21.97	25.28	.50	36.20	42.55	1.11
		2	33.47	35.02	.66	43.92	47.10	1.10
		3(a)	36.70	38.45	.75	46.72	50.17	1.20
	9	1	18.38	20.13	.35	30.29	33.89	.77
		2	27.97	28.14	.46	36.70	37.84	.76
		3(a)	31.41	31.86	.55	39.99	41.57	.88
	6	1	13.52	14.20	.20	22.28	23.91	.43
		2	20.57	20.00	.26	26.99	26.90	.42
		3(a)	24.12	23.79	.35	30.71	31.40	.55
3	12	1	20.66	21.02	.50	34.05	35.37	1.11
		2	32.02	30.11	.66	42.02	40.50	1.10
		3(a)	35.14	33.12	.75	44.74	43.23	1.20
	9	1	17.40	16.94	.35	28.67	28.51	.77
		2	26.84	24.40	.46	35.22	32.81	.76
		3(a)	30.14	27.60	.55	38.37	36.02	.88
	6	1	12.87	12.07	.20	21.20	20.32	.43
		2	19.81	17.49	.26	25.99	23.52	.42
		3(a)	23.20	20.74	.32	29.54	27.07	.55

(a) Not a full year. Program ended at 50,000 miles.

TABLE 195

207(b) PROGRAM EFFICIENCIES FOR THE FEDERAL THREE-MODE; 117 CAR FLEET; STRR=1.0

Maintenance		Number of Years Since 1st Inspection	Estimated Cumulative Program Efficiencies in Percent					
Version	Period of Effectiveness		Over Fleet Life			Over Program Life		
			HC	CO	NOx	HC	CO	NOx
1	12	1	21.70	28.37	.51	35.75	47.74	1.12
		2	33.08	38.52	.66	43.41	51.80	1.10
		3(a)	36.31	42.26	.75	46.23	55.14	1.20
	9	1	18.15	22.43	.36	29.90	37.76	.78
		2	27.63	30.81	.46	36.25	41.44	.76
		3(a)	31.06	34.94	.55	39.55	45.59	.88
	6	1	13.35	15.73	.20	21.99	26.47	.44
		2	20.32	21.79	.26	26.66	29.31	.43
		3(a)	23.86	26.00	.35	30.38	33.93	.55
2	12	1	21.70	25.70	.51	35.75	42.10	1.12
		2	33.08	34.66	.66	43.41	46.61	1.10
		3(a)	36.31	38.07	.75	46.23	49.68	1.20
	9	1	18.15	19.92	.36	29.90	33.53	.78
		2	27.63	27.83	.46	36.25	37.43	.76
		3(a)	31.06	31.54	.55	39.55	41.16	.88
	6	1	13.35	14.05	.20	21.99	23.65	.44
		2	20.32	19.79	.26	26.66	26.62	.43
		3(a)	23.86	23.57	.35	30.38	30.76	.55
3	12	1	19.23	19.35	.39	31.68	32.56	.86
		2	30.35	28.13	.50	39.83	37.83	.84
		3(a)	33.37	30.98	.57	42.49	40.44	.91
	9	1	16.30	15.67	.27	26.85	26.37	.58
		2	25.47	22.84	.34	33.42	30.72	.56
		3(a)	28.60	25.85	.41	36.42	33.74	.66
	6	1	12.11	11.22	.14	19.95	18.88	.31
		2	18.85	16.42	.18	24.73	22.08	.29
		3(a)	22.07	19.46	.25	28.10	25.40	.40

(a) Not a full year. Program ended at 50,000 miles.

TABLE 196

207(b) ST CUT-POINTS FOR EACH ENGINE FAMILY; FEDERAL SHORT CYCLE; EC=5%; 117 CARS

CID[(a)]	Cut-Points in Grams/Mile		
	HC	CO	NO_x
150 and Less	0.89	6.01	2.19
151 to 259	1.28	3.70	2.99
260 and Greater	1.07	1.73	2.52

(a) CID - Cubic Inch Displacement

TABLE 197

FTP VALUES EQUIVALENT TO 207(b) ST CUT-POINTS; FEDERAL SHORT CYCLE; EC=5%; 117 CARS

CID	Equivalent ST Cut-Points - Grams/Mile		
	HC	CO	NO_x
150 and Less	1.92	22.5	3.10
151 to 259	1.84	26.1	3.10
260 and Greater	1.68	23.2	3.10

TABLE 198
207(b) ST CUT-POINTS FOR EACH ENGINE FAMILY; FEDERAL THREE-MODE[(a)]; EC=5%; 117 CARS

CID[(b)]	Cut-Point in PPM		
	HC	CO	NO_x
150 and Less	221	2911	2675
151 to 259	323	9772	1589
260 and Greater	114	11836	1863

(a) The ST was defined from the Federal Three-Mode with HC and CO idle in drive, and NOx in high speed (low speed NOx was used for 151 to 259 CID group)

(b) CID - Cubic Inch Displacement

TABLE 199
FTP VALUES EQUIVALENT TO 207(b) ST CUT-POINTS; FEDERAL THREE-MODE; EC=5%; 117 CARS

CID	Equivalent ST Cut-Points - Grams/Mile		
	HC	CO	NO_x
150 and Less	2.22	22.92	3.10
151 to 259	1,81	29.03	3.10
260 and Greater	1.95	43.49	3.15

TABLE 200

207(b) PROGRAM EFFICIENCIES FOR THE FEDERAL SHORT CYCLE; 117 CAR FLEET; EC=5%

Maintenance		Number of Years Since 1st Inspection	Estimated Cumulative Program Efficiencies in Percent					
			Over Fleet Life			Over Program Life		
Version	Period of Effectiveness		HC	CO	NOx	HC	CO	NOx
1	12	1	22.02	28.73	.50	36.29	48.35	1.10
		2	33.54	39.01	.66	44.01	52.46	1.10
		3(a)	36.77	42.76	.75	46.82	55.80	1.20
	9	1	18.43	22.73	.34	30.37	38.25	.75
		2	28.04	31.23	.46	36.79	42.01	.76
		3(a)	31.48	35.36	.55	40.08	46.15	.88
	6	1	13.56	15.94	.19	22.34	26.82	.41
		2	20.62	22.08	.25	27.05	29.70	.41
		3(a)	24.17	26.30	.34	30.77	34.32	.54
2	12	1	22.02	25.32	.50	36.29	42.61	1.10
		2	33.54	35.08	.66	44.01	47.18	1.10
		3(a)	36.77	38.50	.75	46.82	50.25	1.20
	9	1	18.43	20.17	.34	30.37	33.95	.75
		2	28.04	28.20	.46	36.79	37.92	.76
		3(a)	31.48	31.91	.55	40.08	41.64	.88
	6	1	13.56	14.23	.19	22.34	23.95	.41
		2	20.62	20.04	.25	27.05	26.96	.41
		3(a)	24.17	23.83	.34	30.77	31.10	.54
3	12	1	19.82	21.40	.50	32.65	36.02	1.10
		2	31.11	30.57	.66	40.82	41.12	1.10
		3(a)	34.15	33.62	.75	43.48	43.87	1.20
	9	1	16.78	17.23	.34	27.64	29.00	.75
		2	26.13	24.76	.46	34.29	33.29	.76
		3(a)	29.31	28.00	.55	37.32	36.54	.88
	6	1	12.46	12.27	.19	20.52	20.66	.41
		2	19.32	17.73	.25	25.36	23.84	.41
		3(a)	22.60	21.03	.34	28.78	27.44	.54

(a) Not a full year. Program ended at 50,000 miles.

TABLE 201

207(b) PROGRAM EFFICIENCIES FOR THE FEDERAL THREE-MODE; 117 CAR FLEET; EC=5%

Maintenance		Number of Years Since 1st Inspection	Estimated Cumulative Program Efficiencies in Percent					
			Over Fleet Life			Over Program Life		
Version	Period of Effectiveness		HC	CO	NOx	HC	CO	NOx
1	12	1	18.45	24.09	.52	30.40	40.55	1.14
		2	28.67	33.26	.69	37.61	44.73	1.14
		3[(a)]	31.86	36.85	.77	40.56	48.09	1.23
	9	1	15.34	18.99	.38	25.28	31.97	.84
		2	23.83	26.58	.50	31.26	35.75	.84
		3[(a)]	27.18	30.50	.60	34.61	39.80	.95
	6	1	11.23	13.28	.24	18.50	22.35	.54
		2	17.46	18.81	.32	22.91	25.30	.54
		3[(a)]	30.88	22.81	.42	26.58	29.77	.66
2	12	1	18.45	21.36	.52	30.40	35.94	1.14
		2	28.67	30.01	.69	37.61	40.37	1.14
		3[(a)]	31.86	33.30	.77	40.56	43.45	1.23
	9	1	15.34	16.94	.38	25.28	28.51	.84
		2	23.83	24.09	.50	31.26	32.40	.84
		3[(a)]	27.18	27.63	.60	34.61	36.06	.95
	6	1	11.23	11.91	.24	18.50	20.05	.54
		2	17.46	17.13	.32	22.91	23.04	.54
		3[(a)]	20.88	20.73	.42	26.58	27.05	.66
3	12	1	15.30	15.01	.51	25.21	25.27	1.11
		2	25.06	22.40	.67	32.88	30.12	1.11
		3[(a)]	27.92	24.90	.76	35.55	32.50	1.20
	9	1	12.98	12.18	.37	21.38	20.51	.82
		2	21.00	18.24	.49	27.56	24.53	.82
		3[(a)]	23.93	20.85	.58	30.46	27.21	.93
	6	1	9.65	8.74	.24	15.90	14.71	.52
		2	15.53	13.16	.32	20.38	17.69	.56
		3[(a)]	18.48	15.76	.40	23.54	20.56	.64

[(a)] Not a full year. Program ended at 50,000 miles.

TABLE 202

207(b) ST CUT-POINTS FOR EACH ENGINE FAMILY; FEDERAL SHORT CYCLE; STE=0.6; 117 CARS

CID[a]	Cut-Points in Grams/Mile		
	HC	CO	NO_x
150 and Less	1.35	15.39	2.65
151 to 259	1.07	8.75	3.49
260 and Greater	1.57	18.90	2.75

(a) CID - Cubic Inch Displacement

TABLE 203

FTP VALUES EQUIVALENT TO 207(b) ST CUT-POINTS; FEDERAL SHORT CYCLE; STE=0.6; 117 CARS

CID	Equivalent ST Cut-Points - Grams/Mile		
	HC	CO	NO_x
150 and Less	2.12	29.6	3.10
151 to 259	1.77	30.1	3.26
260 and Greater	2.21	40.0	3.10

TABLE 204
207(b) ST CUT-POINTS FOR EACH ENGINE FAMILY; FEDERAL THREE-MODE[(a)]; STE=0.6; 117 CARS

CID[(b)]	Cut-Point in PPM		
	HC	CO	NO_x
150 and Less	120	11286	2725
151 to 259	182	19821	1407
260 and Greater	131	26019	1418

(a) The ST was defined from the Federal Three-Mode with HC and CO idle in drive, and NOx in high speed (low speed NOx was used for 151 to 259 CID group)

(b) CID - Cubic Inch Displacement

TABLE 205
FTP VALUES EQUIVALENT TO 207(b) ST CUT-POINTS; FEDERAL THREE-MODE; STE=0.6; 117 CARS

CID	Equivalent ST Cut-Points - Grams/Mile		
	HC	CO	NO_x
150 and Less	2.18	27.08	3.10
151 to 259	1.82	33.75	3.10
260 and Greater	2.08	57.04	3.10

TABLE 206

207(b) PROGRAM EFFICIENCIES FOR THE FEDERAL SHORT CYCLE; 177 CAR FLEET; STE=0.6

Maintenance		Number of Years Since 1st Inspection	Estimated Cumulative Program Efficiencies in Percent					
Version	Period of Effectiveness		Over Fleet Life			Over Program Life		
			HC	CO	NOx	HC	CO	NOx
1	12	1	18.81	24.71	.54	30.99	41.59	1.18
		2	29.23	34.26	.70	38.36	46.08	1.16
		3(a)	32.49	37.97	.79	41.37	49.56	1.26
	9	1	15.60	19.45	.39	25.70	32.74	.85
		2	24.36	27.41	.51	31.96	36.87	.84
		3(a)	27.82	31.48	.60	35.42	41.09	.96
	6	1	11.39	13.58	.24	18.76	22.86	.52
		2	17.87	19.39	.31	23.45	26.08	.51
		3(a)	21.41	23.56	.40	27.26	30.74	.64
2	12	1	18.81	21.95	.54	30.99	36.94	1.18
		2	29.23	30.94	.70	38.36	41.61	1.16
		3(a)	32.49	34.31	.79	41.37	44.77	1.26
	9	1	15.60	17.38	.39	25.70	29.25	.85
		2	24.36	24.85	.51	31.96	33.42	.84
		3(a)	27.82	28.52	.6	35.42	37.22	.96
	6	1	11.39	12.20	.24	18.76	20.53	.52
		2	17.87	17.65	.31	23.45	23.74	.51
		3(a)	21.41	21.40	.40	27.26	27.93	.64
3	12	1	15.13	15.13	.50	24.93	25.46	1.09
		2	24.88	22.61	.65	32.65	30.41	1.07
		3(a)	27.72	25.12	.73	35.30	32.79	1.16
	9	1	12.84	12.26	.36	21.15	20.64	.78
		2	20.98	18.45	.47	27.52	24.81	.77
		3(a)	23.91	21.07	.56	30.44	27.50	.89
	6	1	9.55	8.76	.22	15.73	14.79	.47
		2	15.57	13.31	.28	20.43	17.89	.47
		3(a)	18.55	15.94	.37	23.62	20.81	.59

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[a] Not a full year. Program ended at 50,000 miles.

TABLE 207

207(b) PROGRAM EFFICIENCIES FOR THE FEDERAL THREE-MODE; 117 CAR FLEET; STE=0.6

Maintenance		Number of Years Since 1st Inspection	Estimated Cumulative Program Efficiencies in Percent					
Version	Period of Effectiveness		Over Fleet Life			Over Program Life		
			HC	CO	NOx	HC	CO	NOx
1	12	1	16.93	22.27	.49	27.89	37.47	1.08
		2	26.68	31.05	.65	35.01	41.76	1.08
		3(a)	39.85	34.55	.74	38.01	45.08	1.18
	9	1	14.06	17.54	.35	23.17	29.53	.77
		2	22.17	24.85	.47	29.09	33.42	.78
		3(a)	25.48	28.67	.56	32.44	37.41	.90
	6	1	10.29	12.26	.21	16.95	20.62	.46
		2	16.25	17.59	.28	21.32	23.66	.47
		3(a)	19.57	21.47	.37	24.92	28.01	.59
2	12	1	16.93	19.77	.49	27.89	33.27	1.08
		2	26.68	28.06	.65	35.01	37.74	1.08
		3(a)	29.85	31.26	.74	38.01	40.79	1.18
	9	1	14.06	15.67	.35	23.17	26.37	.77
		2	22.17	22.55	.47	29.09	30.32	.78
		3(a)	25.48	26.00	.56	32.44	33.93	.90
	6	1	10.29	11.01	.21	16.95	18.53	.46
		2	16.25	16.03	.28	21.32	21.56	.47
		3(a)	19.57	20.55	.37	24.92	26.53	.59
3	12	1	13.84	11.83	.49	22.81	19.91	1.08
		2	23.06	18.40	.65	30.26	24.75	1.08
		3(a)	25.88	20.57	.74	32.95	26.84	1.18
	9	1	11.75	9.72	.35	19.36	16.36	.77
		2	19.34	15.09	.47	25.38	20.29	.78
		3(a)	22.20	17.28	.56	28.26	22.55	.90
	6	1	8.74	7.04	.21	14.41	11.85	.46
		2	14.32	10.94	.28	18.78	14.72	.47
		3(a)	17.16	13.08	.37	21.85	17.06	.59

(a) Not a full year. Program ended at 50,000 miles.

TABLE 208

207(b) FIRST YEAR EFFICIENCIES FOR THE FEDERAL THREE-MODE USING VERSION 3

Fleet	Selection Technique	Period of Effective Maintenance	Estimated Efficiency at One Year After the First Inspection in Percent		
			HC	CO	NOx
300 Cars	STRR=1.0	12	27.30	33.95	.89
		9	23.61	27.89	-.01
		6	17.66	20.12	-.90
	EC=5%	12	20.84	28.32	1.50
		9	18.15	23.18	.79
		6	13.68	16.70	.08
	STE=.6	12	25.35	30.47	1.12
		9	21.87	25.07	.26
		6	16.35	18.12	-.60
117 Cars	STRR=1.0	12	31.68	32.56	.86
		9	26.85	26.37	.58
		6	19.95	18.88	.31
	EC=5%	12	25.21	25.27	1.11
		9	21.38	20.51	.82
		6	15.90	14.71	.52
	STE=.6	12	22.81	19.91	1.08
		9	19.36	16.36	.77
		6	14.41	11.85	.46

Table 209. Assumed FTP Levels for CEV Fleet

Level	Emission Levels, gm/mi		
	HC	CO	NO_x
I	0.41	3.4	3.1
II	0.60	5.0	3.1
III	0.75	7.0	3.1
IV	0.90	9.0	3.1

TABLE 210

SUMMARY OF CONTINGENCY TABLE ANALYSIS-- HC

FEDERAL TEST PROCEDURE -- 1974 CEV FLEET
FIXED SHORT TEST REJECTION RATIO; STRR= 100%

HC STANDARD (GM/MI)	NO. OF VEHICLES	MODE	CUT POINTS ST UNITS	CUT POINTS FTP UNITS	% CORRECT FAILURES	% EC	% EO	STE	STRR	EC/(EC+FF)	FTP AVG FOR ST PASS	FTP AVG FOR ST FAIL	CORRE-LATION
.41	26		0.42	0.44	64.46	5.74	5.74	0.92	1.00	0.08	0.36	0.81	0.7256
.60	26		0.59	0.62	39.52	6.59	6.59	0.86	1.00	0.14	0.44	1.42	0.7349
.75	26		0.72	0.75	26.14	5.93	5.93	0.82	1.00	0.18	0.45	1.55	0.7278
.90	26		0.85	0.88	17.26	4.91	4.91	0.78	1.00	0.22	0.50	1.83	0.7152

TABLE 211

SUMMARY OF CONTINGENCY TABLE ANALYSIS-- HC

FEDERAL TEST PROCEDURE -- 1974 CEV FLEET
BOUNDED ERRORS OF COMMISSION; EC= 5%

HC STANDARD (GM/MI)	NO. OF VEHICLES	MODE	CUT POINTS		% CORRECT FAILURES	% EC	% EO	STE	STRR	EC/(EC+FF)	PTP AVG FOR ST		CORRE-LATION
			ST UNITS	PTP UNITS							PASS	FAIL	
.41	20		0.44	0.46	63.49	5.00	6.71	0.90	0.98	0.07	0.40	0.84	0.7253
.60	20		0.62	0.65	37.73	5.00	8.38	0.82	0.93	0.12	0.44	1.42	0.7310
.75	20		0.74	0.77	25.27	5.00	6.80	0.79	0.94	0.17	0.45	1.55	0.7257
.90	20		0.85	0.88	17.33	5.00	4.85	0.78	1.01	0.22	0.50	1.83	0.7153

TABLE 212

SUMMARY OF CONTINGENCY TABLE ANALYSIS-- CO

FEDERAL TEST PROCEDURE -- 1974 CEV FLEET
FIXED SHORT TEST REJECTION RATIO; STRR= 100%

CO STANDARD (GM/MI)	NO. OF VEHICLES	MODE	CUT POINTS ST UNITS	CUT POINTS PTP UNITS	% CORRECT FAILURES	% EC	% EO	STE	STRR	EC/(EC+FF)	FTP AVG FOR ST PASS	FTP AVG FOR ST FAIL	CORRE-LATION
3.4	26		3.35	3.28	18.37	5.39	5.39	0.77	1.00	0.23	2.10	4.24	0.7023
5.0	26		4.81	4.59	4.61	2.28	2.28	0.67	1.00	0.33	2.42	5.70	0.6443
7.0	26		6.59	6.19	0.90	0.66	0.66	0.58	1.00	0.42	2.67	0.00	0.5695
9.0	26		8.34	7.76	0.20	0.19	0.19	0.51	1.00	0.49	2.67	0.00	0.5069

TABLE 213

SUMMARY OF CONTINGENCY TABLE ANALYSIS-- CO

FEDERAL TEST PROCEDURE -- 1974 CEV FLEET
BOUNDED ERRORS OF COMMISSION; EC= 5%

CO STANDARD (GM/MI)	NO. OF VEHICLES	MODE	CUT POINTS ST UNITS	CUT POINTS FTP UNITS	% CORRECT FAILURES	% EC	% EO	STE	STRR	EC/(EC+FF)	FTP AVG FOR ST PASS	FTP AVG FOR ST FAIL	CORRE-LATION
3.4	26		3.39	3.32	18.05	5.00	5.71	0.76	0.97	0.22	2.09	4.60	0.7014
5.0	26		4.30	4.14	5.65	5.00	1.24	0.82	1.54	0.47	2.35	5.15	0.6290
7.0	26		4.89	4.66	1.46	5.00	0.10	0.94	4.15	0.77	2.42	5.70	0.4463
9.0	26		5.10	4.85	0.39	5.00	0.00	0.99	13.67	0.93	2.42	5.70	0.2604

TABLE 214

SUMMARY OF CONTINGENCY TABLE ANALYSIS-- NOX

FEDERAL TEST PROCEDURE -- 1974 CEV FLEET
FIXED SHORT TEST REJECTION RATIO; STRR= 100%

NOx STANDARD (GM/MI)	NO. OF VEHICLES	MODE	CUT POINTS ST UNITS	CUT POINTS FTP UNITS	% CORRECT FAILURES	% EC	% EO	STE	STRR	EC/(EC+FF)	FTP AVG FOR ST PASS	FTP AVG FOR ST FAIL	CORRE-LATION
3.1	26		2.99	2.97	11.37	8.37	8.37	0.58	1.00	0.42	2.43	4.31	0.4715

TABLE 215

SUMMARY OF CONTINGENCY TABLE ANALYSIS-- NOX

FEDERAL TEST PROCEDURE -- 1974 CEV FLEET
BOUNDED ERRORS OF COMMISSION; EC= 5%

NOx STANDARD (GM/MI)	NO. OF VEHICLES	MODE	CUT POINTS		% CORRECT FAILURES	% EC	% EO	STE	STRR	EC/(EC+FF)	FTP AVG FOR ST		CORRELATION
			ST UNITS	FTP UNITS							PASS	FAIL	
3.1	26		3.14	3.10	9.04	5.00	10.70	0.46	0.71	0.36	2.43	4.31	0.4532

TABLE 216

SUMMARY OF CONTINGENCY TABLE ANALYSIS-- CMP3

FEDERAL TEST PROCEDURE -- 1974 CEV FLEET
FIXED SHORT TEST REJECTION RATIO; STRR= 100%

CO STANDARD (GM/MI)	NO. OF VEHICLES	MODE	CUT POINTS		% CORRECT FAILURES	% EC	% EO	STE	STRR	EC/(EC+FF)	FTP AVG FOR ST		CORRE-LATION
			ST UNITS	FTP UNITS							PASS	FAIL	
3.4	26				61.54	15.38	3.85	0.94	1.18	0.20			0.5609
5.0	26				30.77	0.00	7.69	0.80	0.80	0.00			0.8433
7.0	26				30.77	0.00	0.00	1.00	1.00	0.00			1.0000
9.0	26				19.23	3.85	7.69	0.71	0.86	0.17			0.6966

TABLE 217

SUMMARY OF CONTINGENCY TABLE ANALYSIS-- CMP3

FEDERAL TEST PROCEDURE -- 1974 CEV FLEET
BOUNDED ERRORS OF COMMISSION; EC= 5%

CO STANDARD (GM/MI)	NO. OF VEHICLES	MODE	CUT POINTS		% CORRECT FAILURES	% EC	% EO	STE	STRR	EC/(EC+FF)	FTP AVG FOR ST		CORRELATION
			ST UNITS	FTP UNITS							PASS	FAIL	
3.4	26				57.69	15.38	7.69	0.88	1.12	0.21			0.4697
5.0	26				30.77	3.85	7.69	0.80	0.90	0.11			0.7542
7.0	26				30.77	0.00	0.00	1.00	1.00	0.00			1.0000
9.0	26				19.23	3.85	7.69	0.71	0.86	0.17			0.6966

TABLE 218

SUMMARY OF CONTINGENCY TABLE ANALYSIS-- HC
GROUPED BY INERTIA WT
FEDERAL SHORT CYCLE -- 144 CAR FLEET (MY 1974)
FIXED SHORT TEST REJECTION RATIO: STRR= 100%

INERTIA WT	NO. OF VEHICLES	MODE	CUT POINTS ST UNITS	CUT POINTS FTP UNITS	% CORRECT FAILURES	% EC	% EO	STE	STRR	EC/(EC+FF)	FTP AVG FOR ST PASS	FTP AVG FOR ST FAIL	CORRELATION
ALL	144		2.5[illegible]	2.99	24.00	6.38	6.38	0.79	1.00	0.21	1.84	4.40	0.6985
2501 TO 3500	46		2.67	3.00	8.06	3.72	3.72	0.68	1.00	0.32	1.70	3.92	0.6420
3501 TO 4501	49		2.25	3.08	75.58	5.68	5.68	0.93	1.00	0.07	2.78	4.49	0.6270
FROM 4501	49		2.74	2.29	0.20	0.92	0.92	0.18	1.00	0.82	1.77	2.15	0.1672

TABLE 219

SUMMARY OF CONTINGENCY TABLE ANALYSIS-- HC
GROUPED BY INERTIA WT
FEDERAL THREE-MODE -- 144 CAR FLEET (MY 1974)
FIXED SHORT TEST REJECTION RATIO: STRR= 100%

INERTIA WT	NO. OF VEHICLES	MODE	CUT POINTS ST UNITS	CUT POINTS FTP UNITS	% CORRECT FAILURES	% EC	% EO	STE	STRR	EC/(EC+FF)	FTP AVG FOR ST PASS	FTP AVG FOR ST FAIL	CORRE-LATION
ALL	144	H	44.07	2.79	16.85	16.14	16.14	0.51	1.00	0.49	2.19	3.39	0.2701
	144	L	61.73	2.74	17.50	14.60	14.60	0.55	1.00	0.45	2.13	3.82	0.3302
	144	I	48.94	2.63	18.69	14.22	14.22	0.57	1.00	0.43	2.11	3.74	0.3560
2501 TO 3500	46	H	89.61	2.57	3.60	7.78	7.78	0.32	1.00	0.68	1.81	2.78	0.2283
	46	L	130.07	2.82	4.49	7.29	7.29	0.38	1.00	0.62	1.70	3.88	0.2984
	46	I	132.92	2.49	5.38	6.95	6.95	0.44	1.00	0.56	1.70	3.88	0.3573
3501 TO 4501	49	H	26.68	3.90	67.30	13.96	13.96	0.83	1.00	0.17	4.11	4.29	0.0833
	49	L	39.65	4.01	67.29	13.97	13.97	0.83	1.00	0.17	3.50	4.35	0.0830
	49	I	24.10	3.56	70.25	11.01	11.01	0.86	1.00	0.14	3.19	4.39	0.2771
FROM 4501	49	H	104.36	2.12	0.03	1.86	1.86	0.02	1.00	0.98	1.79	0.00	-0.0028
	49	L	144.90	1.75	0.02	1.32	1.32	0.01	1.00	0.99	1.79	0.00	-0.0015
	49	I	123.76	1.63	0.01	1.80	1.80	0.01	1.00	0.99	1.79	1.70	-0.0110

TABLE 220

SUMMARY OF CONTINGENCY TABLE ANALYSIS-- HC
GROUPED BY INERTIA WT
FEDERAL SHORT CYCLE -- 144 CAR FLEET (MY 1974)
BOUNDED ERRORS OF COMMISSION: EC= 5%

INERTIA WT	NO. OF VEHICLES	MODE	CUT POINTS ST UNITS	CUT POINTS FTP UNITS	% CORRECT FAILURES	% EC	% EO	STE	STRR	EC/(EC+FF)	FTP AVG FOR ST PASS	FTP AVG FOR ST FAIL	CORRE-LATION
ALL	144		2.62	3.11	22.71	5.00	7.67	0.75	0.91	0.18	1.86	4.46	0.6944
2501 TO 3500	46		2.57	2.88	8.75	5.00	3.03	0.74	1.17	0.36	1.70	3.92	0.6424
3501 TO 4501	49		2.31	3.13	74.48	5.00	6.78	0.92	0.98	0.06	2.85	4.51	0.6280
FROM 4501	49		2.24	2.09	0.51	5.00	0.61	0.46	4.94	0.91	1.77	2.15	0.1866

TABLE 221

SUMMARY OF CONTINGENCY TABLE ANALYSIS-- HC
GROUPED BY INERTIA WT
FEDERAL THREE-MODE -- 144 CAR FLEET (MY 1974)
BOUNDED ERRORS OF COMMISSION: EC= 5%

INERTIA WT	NO. OF VEHICLES	MODE	CUT POINTS ST UNITS	CUT POINTS FTP UNITS	% CORRECT FAILURES	% EC	% EO	STE	STRR	EC/(EC+FF)	FTP AVG FOR ST PASS	FTP AVG FOR ST FAIL	CORRE-LATION
ALL	144	H	92.93	3.92	7.79	5.00	25.20	0.24	0.39	0.39	2.46	4.61	0.2275
	144	L	131.75	3.84	9.29	5.00	22.82	0.29	0.44	0.35	2.41	4.60	0.2876
	144	I	105.67	3.35	10.37	5.00	22.53	0.32	0.47	0.33	2.39	4.65	0.3136
2501 TO 3500	46	H	107.66	2.84	2.68	5.00	8.70	0.24	0.68	0.65	1.82	3.46	0.2138
	46	L	156.58	3.17	3.59	5.00	8.19	0.30	0.73	0.58	1.77	3.67	0.2854
	46	I	163.12	2.73	4.51	5.00	7.82	0.37	0.77	0.53	1.77	3.67	0.3460
3501 TO 4501	49	H	63.70	4.28	30.20	5.00	51.05	0.37	0.43	0.14	4.05	4.47	0.0857
	49	L	102.85	4.27	30.17	5.00	51.09	0.37	0.43	0.14	4.01	4.61	0.0854
	49	I	49.20	3.84	50.01	5.00	31.24	0.62	0.68	0.09	3.74	4.59	0.2735
FROM 4501	49	H	64.20	1.97	0.08	5.00	1.80	0.04	2.69	0.98	1.79	0.00	-0.0040
	49	L	74.01	1.77	0.06	5.00	1.28	0.05	3.78	0.99	1.79	0.00	-0.0024
	49	I	72.62	1.70	0.04	5.00	1.77	0.02	2.79	0.99	1.79	1.70	-0.0167

TABLE 222

SUMMARY OF CONTINGENCY TABLE ANALYSIS-- CO
GROUPED BY INERTIA WT
FEDERAL SHORT CYCLE -- 144 CAR FLEET (MY 1974)
FIXED SHORT TEST REJECTION RATIO; STRR= 100%

INERTIA WT	NO. OF VEHICLES	MODE	CUT POINTS ST UNITS	CUT POINTS FTP UNITS	% CORRECT FAILURES	% EC	% EO	STE	STRR	EC/(EC+FF)	FTP AVG FOR ST PASS	FTP AVG FOR ST FAIL	CORRE-LATION
ALL	144		18.08	28.74	66.99	7.49	7.49	0.90	1.00	0.10	24.91	54.66	0.6062
2501 TO 3500	46		17.29	29.92	70.90	6.13	6.13	0.92	1.00	0.08	26.02	42.76	0.6533
3501 TO 4501	49		16.57	30.22	89.03	2.22	2.22	0.98	1.00	0.02	24.11	78.32	0.7225
FROM 4501	49		21.05	28.96	38.02	15.24	15.24	0.71	1.00	0.29	25.00	35.16	0.3876

TABLE 223

SUMMARY OF CONTINGENCY TABLE ANALYSIS-- CO[(1)]
GROUPED BY INERTIA WT
FEDERAL THREE-MODE -- 144 CAR FLEET (MY 1974)
FIXED SHORT TEST REJECTION RATIO: STRR= 100%

INERTIA WT	NO. OF VEHICLES	MODE	CUT POINTS ST UNITS	CUT POINTS FTP UNITS	% CORRECT FAILURES	% EC	% EO	STE	STRR	EC/(EC+FF)	FTP AVG FOR ST PASS	FTP AVG FOR ST FAIL	CORRE-LATION
ALL	144	H	0.11	40.45	56.43	17.87	17.87	0.76	1.00	0.24	46.81	48.00	0.0644
	144	L	0.19	39.11	59.43	15.09	15.09	0.80	1.00	0.20	36.64	51.57	0.2050
	144	I	0.20	39.05	64.27	10.41	10.41	0.86	1.00	0.14	28.52	55.24	0.4498
2501 TO 3500	46	H	0.12	35.97	61.82	15.27	15.27	0.80	1.00	0.20	31.48	41.04	0.1351
	46	L	0.34	32.81	62.93	14.10	14.10	0.82	1.00	0.18	33.51	39.54	0.2028
	46	I	0.19	34.60	64.73	12.30	12.30	0.84	1.00	0.16	32.96	39.98	0.3046
3501 TO 4501	49	H	0.06	57.58	83.50	7.46	7.46	0.92	1.00	0.08	74.24	72.59	0.0929
	49	L	0.11	51.37	84.61	6.35	6.35	0.93	1.00	0.07	58.59	74.77	0.2278
	49	I	0.24	56.55	86.32	4.92	4.92	0.95	1.00	0.05	27.09	79.17	0.3840
FROM 4501	49	H	0.17	31.14	23.99	29.28	29.28	0.45	1.00	0.55	34.37	28.13	-0.1761
	49	L	0.18	29.93	30.53	23.01	23.01	0.57	1.00	0.43	29.08	32.21	0.0748
	49	I	0.17	29.43	34.36	18.91	18.91	0.65	1.00	0.35	28.17	34.04	0.2404

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(1) ST units are in percent.

TABLE 224

SUMMARY OF CONTINGENCY TABLE ANALYSIS-- CO
GROUPED BY INERTIA WT
FEDERAL SHORT CYCLE -- 144 CAR FLEET (MY 1974)
BOUNDED ERRORS OF COMMISSION: EC= 5%

INERTIA WT	NO. OF VEHICLES	MODE	CUT POINTS		% CORRECT FAILURES	% EC	% EO	STE	STRR	EC/(EC+FF)	FTP AVG FOR ST		CORRELATION
			ST UNITS	FTP UNITS							PASS	FAIL	
ALL	144		20.81	31.50	62.63	5.00	11.85	0.84	0.91	0.07	26.75	57.12	0.6009
2501 TO 3500	46		17.99	30.61	69.14	5.00	7.90	0.90	0.96	0.07	26.57	43.06	0.6530
3501 TO 4501	49		12.50	25.77	90.97	5.00	0.28	1.00	1.05	0.05	21.06	77.39	0.6120
FROM 4501	49		34.05	32.43	22.14	5.00	31.13	0.42	0.51	0.18	26.80	43.16	0.3463

TABLE 225

SUMMARY OF CONTINGENCY TABLE ANALYSIS-- CO[(1)]
GROUPED BY INERTIA WT
FEDERAL THREE-MODE -- 144 CAR FLEET (MY 1974)
BOUNDED ERRORS OF COMMISSION: EC= 5%

INERTIA WT	NO. OF VEHICLES	MODE	CUT POINTS ST UNITS	CUT POINTS FTP UNITS	% CORRECT FAILURES	% EC	% EO	STE	STRR	EC/(EC+FF)	FTP AVG FOR ST PASS	FTP AVG FOR ST FAIL	CORRE-LATION
ALL	144	H	0.37	50.81	18.61	5.00	55.48	0.25	0.32	0.21	43.80	60.02	0.0602
	144	L	0.51	46.95	30.30	5.00	44.23	0.41	0.47	0.14	40.42	60.01	0.1917
	144	I	0.40	40.66	51.69	5.00	22.99	0.69	0.76	0.09	30.37	60.32	0.4342
2501 TO 3500	46	H	0.34	38.88	28.03	5.00	49.07	0.36	0.43	0.15	36.47	43.49	0.1298
	46	L	0.78	38.15	34.09	5.00	42.95	0.44	0.51	0.13	35.93	44.59	0.1937
	46	I	0.56	35.85	43.48	5.00	33.56	0.56	0.63	0.10	34.40	46.19	0.2918
3501 TO 4501	49	H	0.12	61.16	66.07	5.00	24.89	0.73	0.78	0.07	67.29	75.72	0.1096
	49	L	0.15	53.42	78.65	5.00	12.31	0.86	0.92	0.06	53.49	76.01	0.2416
	49	I	0.24	56.51	86.53	5.00	4.72	0.95	1.00	0.05	27.09	79.17	0.3828
FROM 4501	49	H	0.51	29.29	2.42	5.00	50.85	0.05	0.14	0.67	29.91	40.86	-0.1173
	49	L	0.49	33.50	7.86	5.00	45.69	0.15	0.24	0.39	30.16	33.33	0.0583
	49	I	0.39	32.91	14.20	5.00	39.07	0.27	0.36	0.26	28.77	36.44	0.2021

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(1) ST cut-point units are percent.

TABLE 226

SUMMARY OF CONTINGENCY TABLE ANALYSIS-- NOX
GROUPED BY INERTIA WT
FEDERAL SHORT CYCLE -- 144 CAR FLEET (MY 1974)
FIXED SHORT TEST REJECTION RATIO; STRR= 100%

INERTIA WT	NO. OF VEHICLES	MODE	CUT POINTS ST UNITS	CUT POINTS FTP UNITS	% CORRECT FAILURES	% EC	% EO	STE	STRR	EC/(EC+FF)	FTP AVG FOR ST PASS	FTP AVG FOR ST FAIL	CORRE-LATION
ALL	144		2.67	2.40	8.61	8.64	8.64	0.50	1.00	0.50	2.01	3.13	0.3946
2501 TO 3500	46		3.98	1.49	0.41	1.78	1.78	0.19	1.00	0.81	1.45	0.81	0.1679
3501 TO 4501	49		3.14	3.00	19.59	9.17	9.17	0.68	1.00	0.32	2.38	3.29	0.5524
FROM 4501	49		1.75	2.94	11.03	9.15	9.15	0.55	1.00	0.45	2.31	4.05	0.4322

TABLE 227

SUMMARY OF CONTINGENCY TABLE ANALYSIS-- NOX
GROUPED BY INERTIA WT
FEDERAL THREE-MODE -- 144 CAR FLEET (MY 1974)
FIXED SHORT TEST REJECTION RATIO: STRR= 100%

INERTIA WT	NO. OF VEHICLES	MODE	CUT POINTS ST UNITS	CUT POINTS FTP UNITS	% CORRECT FAILURES	% EC	% EO	STE	STRR	EC/(EC+FF)	FTP AVG FOR ST PASS	FTP AVG FOR ST FAIL	CORRE-LATION
ALL	144	H	1497.89	2.54	7.59	9.65	9.65	0.44	1.00	0.56	2.03	2.95	0.3235
	144	L	1345.51	2.50	6.67	10.57	10.57	0.39	1.00	0.61	1.97	2.78	0.2590
	144	I	258.88	2.47	7.15	10.10	10.10	0.41	1.00	0.59	2.06	2.85	0.2925
2501 TO 3500	46	H	2066.64	2.67	0.60	1.59	1.59	0.27	1.00	0.73	1.42	2.47	0.2576
	46	L	1572.92	2.41	0.66	1.52	1.52	0.30	1.00	0.70	1.41	2.77	0.2882
	46	I	386.09	2.65	0.54	1.64	1.64	0.25	1.00	0.75	1.44	0.00	0.2313
3501 TO 4501	49	H	1978.61	2.87	14.60	14.17	14.17	0.51	1.00	0.49	2.39	3.49	0.3087
	49	L	2035.04	2.94	17.37	11.40	11.40	0.60	1.00	0.40	2.41	3.28	0.4438
	49	I	362.90	2.81	12.78	15.98	15.98	0.44	1.00	0.56	2.53	2.99	0.2199
FROM 4501	49	H	816.84	2.88	9.67	10.51	10.51	0.48	1.00	0.52	2.36	3.99	0.3475
	49	L	341.38	2.85	12.11	8.07	8.07	0.60	1.00	0.40	2.32	4.02	0.4988
	49	I	128.55	2.92	10.63	9.55	9.55	0.53	1.00	0.47	2.28	3.49	0.4070

TABLE 228

SUMMARY OF CONTINGENCY TABLE ANALYSIS-- NOX
GROUPED BY INERTIA WT
FEDERAL SHORT CYCLE -- 144 CAR FLEET (MY 1974)
BOUNDED ERRORS OF COMMISSION: EC= 5%

INERTIA WT	NO. OF VEHICLES	MODE	CUT POINTS ST UNITS	CUT POINTS FTP UNITS	% CORRECT FAILURES	% EC	% EO	STE	STRR	EC/(EC+FF)	FTP AVG FOR ST PASS	FTP AVG FOR ST FAIL	CORRELATION
ALL	144		3.08	2.50	6.49	5.00	10.75	0.38	0.67	0.44	2.10	3.13	0.3743
2501 TO 3500	46		3.07	1.47	0.76	5.00	1.42	0.35	2.64	0.87	1.45	0.81	0.1871
3501 TO 4501	49		3.39	3.16	15.70	5.00	13.07	0.55	0.72	0.24	2.42	3.60	0.5313
FROM 4501	49		1.91	3.14	8.24	5.00	11.94	0.41	0.66	0.38	2.32	4.31	0.4094

TABLE 229

SUMMARY OF CONTINGENCY TABLE ANALYSIS-- NOX
GROUPED BY INERTIA WT
FEDERAL THREE-MODE -- 144 CAR FLEET (MY 1974)
BOUNDED ERRORS OF COMMISSION; EC= 5%

INERTIA WT	NO. OF VEHICLES	MODE	CUT POINTS ST UNITS	CUT POINTS FTP UNITS	% CORRECT FAILURES	% EC	% EO	STE	STRR	EC/(EC+FF)	FTP AVG FOR ST PASS	FTP AVG FOR ST FAIL	CORRELATION
ALL	144	H	1793.72	2.75	5.16	5.00	12.08	0.30	0.59	0.49	2.10	3.31	0.2986
	144	L	1954.19	2.85	4.09	5.00	13.16	0.24	0.53	0.55	2.09	3.16	0.2322
	144	I	325.52	2.68	4.63	5.00	12.62	0.27	0.56	0.52	2.13	2.81	0.2664
2501 TO 3500	46	H	1627.59	2.23	1.08	5.00	1.10	0.50	2.79	0.82	1.42	2.47	0.2719
	46	L	1154.33	2.02	1.19	5.00	1.00	0.54	2.83	0.81	1.40	1.86	0.2988
	46	I	294.70	2.20	0.99	5.00	1.19	0.45	2.74	0.83	1.44	1.21	0.2479
3501 TO 4501	49	H	2382.64	3.10	7.69	5.00	21.08	0.27	0.44	0.39	2.63	3.18	0.2681
	49	L	2263.15	3.16	11.76	5.00	17.00	0.41	0.58	0.30	2.47	3.64	0.4104
	49	I	465.54	3.01	5.57	5.00	23.20	0.19	0.37	0.47	2.62	2.82	0.1817
FROM 4501	49	H	905.76	3.11	6.34	5.00	13.84	0.31	0.56	0.44	2.39	4.00	0.3184
	49	L	370.90	2.99	9.90	5.00	10.27	0.49	0.74	0.34	2.32	4.02	0.4825
	49	I	141.96	3.13	7.65	5.00	12.53	0.38	0.63	0.40	2.30	4.14	0.3820

TABLE 230

SUMMARY OF CONTINGENCY TABLE ANALYSIS-- CMP3
GROUPED BY INERTIA WT
FEDERAL SHORT CYCLE -- 144 CAR FLEET (MY 1974)
FIXED SHORT TEST REJECTION RATIO: STRR= 100%

INERTIA WT	NO. OF VEHICLES	MODE	CUT POINTS ST UNITS	CUT POINTS FTP UNITS	% CORRECT FAILURES	% EC	% EO	STE	STRR	EC/(EC+FF)	FTP AVG FOR ST PASS	FTP AVG FOR ST FAIL	CORRELATION
ALL	144				68.75	11.11	11.11	0.86	1.00	0.14			0.3091
2501 TO 3500	46				71.74	4.35	8.70	0.89	0.95	0.06			0.6228
3501 TO 4501	49				91.84	4.08	4.08	0.96	1.00	0.04			-0.0426
FROM 4501	49				42.86	22.45	20.41	0.68	1.03	0.34			0.0672

TABLE 231

SUMMARY OF CONTINGENCY TABLE ANALYSIS-- CMP3
GROUPED BY INERTIA WT
FEDERAL THREE-MODE -- 144 CAR FLEET (MY 1974)
FIXED SHORT TEST REJECTION RATIO: STRR= 100%

INERTIA WT	NO. OF VEHICLES	MODE	CUT POINTS ST UNITS	CUT POINTS FTP UNITS	% CORRECT FAILURES	% EC	% EO	STE	STRR	EC/(EC+FF)	FTP AVG FOR ST PASS	FTP AVG FOR ST FAIL	CORRE-LATION
ALL	144	H			62.50	15.97	17.36	0.78	0.98	0.20			-0.0102
	144	L			68.06	12.50	11.81	0.85	1.01	0.16			0.2346
	144	I			65.28	11.11	14.58	0.82	0.96	0.15			0.2509
		B			66.67	10.42	13.19	0.83	0.97	0.14			0.3030
2501 TO 3500	46	H			60.87	15.22	19.57	0.76	0.95	0.20			-0.0195
	46	L			71.74	15.22	8.70	0.89	1.08	0.17			0.1344
	46	I			69.57	13.04	10.87	0.86	1.03	0.16			0.2074
		B			67.39	10.87	13.04	0.84	0.97	0.14			0.2715
3501 TO 4501	49	H			87.76	4.08	8.16	0.91	0.96	0.04			-0.0615
	49	L			93.88	4.08	2.04	0.98	1.02	0.04			-0.0298
	49	I			91.84	4.08	4.08	0.96	1.00	0.04			-0.0426
		B			91.84	2.04	4.08	0.96	0.98	0.02			0.3775
FROM 4501	49	H			38.78	24.49	24.49	0.61	1.00	0.39			-0.0538
	49	L			40.82	18.37	22.45	0.65	0.94	0.31			0.1424
	49	I			46.94	16.33	16.33	0.74	1.00	0.26			0.2975
		B			40.82	18.37	22.45	0.65	0.94	0.31			0.1424

TABLE 232

SUMMARY OF CONTINGENCY TABLE ANALYSIS-- CMP3
GROUPED BY INERTIA WT
FEDERAL SHORT CYCLE -- 144 CAR FLEET (MY 1974)
BOUNDED ERRORS OF COMMISSION: EC= 5%

INERTIA WT	NO. OF VEHICLES	MODE	CUT POINTS ST UNITS	CUT POINTS FTP UNITS	% CORRECT FAILURES	% EC	% EO	STE	STRR	EC/(EC+FF)	FTP AVG FOR ST PASS	FTP AVG FOR ST FAIL	CORRE-LATION
ALL	144				61.81	9.72	18.06	0.77	0.90	0.14			0.2587
2501 TO 3500	46				69.57	4.35	10.87	0.86	0.92	0.06			0.5806
3501 TO 4501	49				91.84	4.08	4.08	0.96	1.00	0.04			-0.0426
FROM 4501	49				28.57	6.12	34.69	0.45	0.55	0.18			0.2886

TABLE 233

SUMMARY OF CONTINGENCY TABLE ANALYSIS-- CMP3
GROUPED BY INERTIA WT
FEDERAL THREE-MODE -- 144 CAR FLEET (MY 1974)
BOUNDED ERRORS OF COMMISSION: EC= 5%

INERTIA WT	NO. OF VEHICLES	MODE	CUT POINTS ST UNITS	CUT POINTS FTP UNITS	% CORRECT FAILURES	% EC	% EO	STE	STRR	EC/(EC+FF)	FTP AVG FOR ST PASS	FTP AVG FOR ST FAIL	CORRE-LATION
ALL	144	H			29.17	3.47	50.69	0.37	0.41	0.11			0.1649
	144	L			41.67	5.56	38.19	0.52	0.59	0.12			0.1975
	144	I			55.56	5.56	24.31	0.70	0.77	0.09			0.3453
		B			51.39	4.17	28.47	0.64	0.70	0.07			0.3524
2501 TO 3500	46	H			28.26	6.52	52.17	0.35	0.43	0.19			0.0150
	46	L			34.78	4.35	45.65	0.43	0.49	0.11			0.1709
	46	I			36.96	2.17	43.48	0.46	0.49	0.06			0.2832
		B			47.83	2.17	32.61	0.59	0.62	0.04			0.3836
3501 TO 4501	49	H			65.31	2.04	30.61	0.68	0.70	0.03			0.0763
	49	L			87.76	4.08	8.16	0.91	0.96	0.04			-0.0615
	49	I			89.80	2.04	6.12	0.94	0.96	0.02			0.3152
		B			89.80	2.04	6.12	0.94	0.96	0.02			0.3152
FROM 4501	49	H			16.33	0.00	46.94	0.26	0.26	0.00			0.3366
	49	L			24.49	8.16	38.78	0.39	0.52	0.25			0.1695
	49	I			32.65	8.16	30.61	0.52	0.65	0.20			0.2883
		B			24.49	4.08	38.78	0.39	0.45	0.14			0.2945

TABLE 234

FTP FAILURE RATES AND THEIR STANDARD ERRORS: 300 CARS

CID Group	No. of Vehicles	Estimated Failure Rate and Standard Error in Percent					
		HC		CO		NOx	
		F[1]	SE[2]	F	SE	F	SE
All	300	31.71	2.67	53.82	2.88	21.15	2.36
≤150 CID	95	32.14	4.79	44.70	5.10	15.53	3.72
151-259 CID	45	27.27	6.06	55.54	6.76	19.98	5.44
≥260 CID	151	32.89	3.82	57.15	4.03	24.78	3.51

[1] F - Failures

[2] SE - Standard Error

TABLE 235

STANDARD ERRORS FOR THE FTP STANDARDS(1); 300 CARS

CID Group	No. of Vehicles	Estimated Standard Errors Grams/Mile		
		HC	CO	NOx
All	300	0.0767	0.9500	0.1330
≤ 150 CID	95	0.1248	1.2505	0.3300
151-259 CID	54	0.1806	1.8802	0.2737
≥ 260 CID	151	0.1143	1.5843	0.1518

(1) FTP standards are 1.5 gm/mi HC, 15.0 gm/mi CO, and 3.1 gm/mi NOx

TABLE 236

ST CUT-POINTS AND THEIR STANDARD ERRORS FOR THE FEDERAL SHORT CYCLE; 300 CARS

ST Cut-Point Policy	Cut-Points and Standard Errors in Grams/Mile					
	HC		CO		NOx	
	CP(1)	SE(2)	CP	SE	CP	SE
STRR = 1.0	1.09	0.077	5.17	0.618	2.45	0.112
$\frac{E_c}{E_c+FF}$ = .1	2.06	0.190	9.91	1.201	3.69	0.235
.2	1.37	0.108	4.51	0.542	3.00	0.157
EC = 5%	1.32	0.121	8.40	1.312	2.62	0.134
STE = .6	1.29	0.117	11.25	1.367	2.63	0.157
.7	1.07	0.099	8.12	1.001	2.38	0.144
.8	0.86	0.085	5.60	0.728	2.12	0.137

(1) CP - Cut-Point

(2) SE - Standard Error

TABLE 237

ST CUT-POINTS AND THEIR STANDARD ERRORS FOR THE FEDERAL THREE MODE[(3)]; 300 CARS

ST Cut-Point Policy	Cut-Points and Standard Errors in PPM					
	HC		CO		NOx	
	CP[(1)]	SE[(2)]	CP	SE	CP	SE
STRR= 1. 0	112	8. 7	2198	384	1803	85
$\frac{E_c}{E_c+FF}$ = . 1	573	99. 1	12945	2409	-	-
. 2	298	32. 6	2956	515	4379	552
E_c= 5%	184	21. 1	7081	1857	2265	149
STE=. 6	112	12. 6	5867	1157	1558	123
. 7	89	10. 3	3475	703	1362	112
. 8	68	8. 5	1898	412	1164	103

(1) CP - Cut-Point

(2) SE - Standard Error

(3) HC and CO Idle in Drive; NOx at the High Speed

TABLE 238

COMPARISON OF STANDARD ERRORS FOR FEDERAL SHORT CYCLE: 300 CARS; STRR=1.0

CID Group	No. of Vehicles	Cut-Points and Standard Errors in Grams/Mile					
		HC		CO		NOx	
		CP(1)	SE(2)	CP	SE	CP	SE
All	300	1.09	0.077	5.17	0.618	2.45	0.112
≤150 CID	95	1.03	0.125	8.90	1.163	2.33	0.224
151-259 CID	54	0.96	0.168	4.47	1.067	2.50	0.246
≥260 CID	151	1.07	0.118	3.75	0.772	2.49	0.137

(1) CP - Cut-Point

(2) SE - Standard Error

TABLE 239

COMPARISON OF STANDARD ERRORS FOR FEDERAL THREE-MODE(3): 300 CARS; STRR=1.0

CID Group	No. of Vehicles	Cut-Points and Standard Errors in PPM					
		HC		CO		NOx	
		CP(1)	SE(2)	CP	SE	CP	SE
All	300	112	8.7	2198	384	1803	85
≤ 150 CID	95	124	16.8	5907	1464	2475	259
151-259 CID	54	138	21.7	2446	915	1572	154
≥ 260 CID	151	97	10.9	1121	315	1589	93

(1) CP - Cut-Point

(2) SE - Standard Error

(3) HC, CO idle in drive, NOx at high speed

TABLE 240

STANDARD ERRORS FOR CONTINGENCY TABLE PARAMETERS: FEDERAL SHORT CYCLE; 300 CARS; STRR=1.0

Pollutant	Contingency Table Parameters and Their Standard Errors in Percent					
	FF		E_c		E_o	
	P(1)	SE(2)	P	SE	P	SE
HC	22.70	2.45	9.01	2.78	9.01	2.80
CO	44.07	2.96	9.75	2.90	9.75	2.88
NOx	14.24	2.11	6.91	2.57	6.91	2.68

(1)P - Parameter Value

(2)SE - Standard Error of Parameter Value

TABLE 241

STANDARD ERRORS FOR CONTINGENCY TABLE PARAMETERS: FEDERAL THREE-MODE; 300 CARS; STRR= 1. 0

Pollutant[3]	Contingency Table Parameters and Their Standard Errors in Percent					
	FF		E_c		E_o	
	P[1]	SE[2]	P	SE	P	SE
HC	19.01	2.29	12.70	2.78	12.70	2.81
CO	43.42	3.08	12.41	2.96	12.41	2.92
NOx	10.24	1.77	10.91	2.54	10.91	2.72

(1)P - Parameter Value

(2)SE - Standard Error of Parameter Value

(3)HC, CO Idle in Drive, NOx at High Speed

TABLE 242

FTP FAILURE RATES AND THEIR STANDARD ERRORS: 117 CARS

No. of Vehicles	Estimated Failure Rate and Standard Error in Percent					
	HC		CO		NOx	
	F[1]	SE[2]	F	SE	F	SE
117	68.05	4.31	90.77	2.68	5.67	2.14

(1)F - Failures

(2)SE - Standard Error

TABLE 243

STANDARD ERRORS FOR THE FTP STANDARDS; 117 CARS

No. of Vehicles	FTP Cut-Points and Standard Errors in Grams/Mile					
	HC		CO		NOx	
	CP(1)	SE(2)	CP	SE	CP	SE
117	1.50	0.109	15.0	2.97	3.10	0.563

(1) CP - Cut-Point

(2) SE - Standard Error

TABLE 244

ST CUT-POINTS AND STANDARD ERRORS FOR 117 CARS; STRR=1.0

Short Test	ST Cut-Points and Their Standard Errors(1)					
	HC		CO		NOx	
	CP(2)	SE(3)	CP	SE	CP	SE
Federal Short Cycle	0.86	0.080	4.06	0.743	2.95	0.325
Federal Three-Mode(4)	75	9.5	605	197	2442	322

(1) Units are grams/mile for the Federal Short Cycle and ppm for the Federal Three-Mode

(2) CP - Cut-Point

(3) SE - Standard Error

(4) HC, CO idle in drive, NOx at high speed

TABLE 245

CONTINGENCY TABLE PARAMETERS AND THEIR STANDARD ERRORS: FEDERAL SHORT CYCLE; 117 CARS; STRR= 1.0

Pollutant	Contingency Table Parameters and Their Standard Errors in Percent					
	FF		E_c		E_o	
	P(1)	SE(2)	P	SE	P	SE
HC	59.35	4.99	8.70	4.48	8.70	4.43
CO	86.83	4.79	3.94	3.95	3.94	3.28
NOx	3.29	2.34	2.38	2.86	2.38	4.48

(1)P - Parameter Value

(2)SE - Standard Error of Parameter Value

TABLE 246

CONTINGENCY TABLE PARAMETERS AND THEIR STANDARD ERRORS: FEDERAL THREE-MODE[3]; 117 CARS; STRR= 1.0

Pollutant	Contingency Table Parameters and Their Standard Errors in Percent					
	FF		E_c		E_o	
	P[1]	SE[2]	P	SE	P	SE
HC	53.97	5.41	14.20	4.52	14.70	4.44
CO	84.77	5.52	6.00	4.15	6.00	3.09
NOx	1.97	1.68	3.69	2.72	3.69	4.63

[1] P - Parameter Value

[2] SE - Standard Error of Parameter Value

[3] HC, CO idle in drive; NOx at the High Speed

TABLE 247

COMPARISON OF ST DISPERSION FOR STRR= 1.0 BY FLEET AND ST

Vehicle Fleet	ST	ST Cut-Point Dispersion(1)		
		HC	CO	NOx
300 Cars	Federal Short Cycle	0.071	0.120	0.046
	Federal Three-Mode(2)	0.078	0.175	0.047
117 Cars	Federal Short Cycle	0.093	0.183	0.110
	Federal Three-Mode(2)	0.127	0.326	0.132

(1) Dispersion - (Standard Error) ÷ (the cut-point value)

(2) HC, CO idle in drive, NOx at high speed

GLOSSARY

CID	cubic inch displacement
CO	carbon monoxide
CVS	constant volume sampling
E_c	error of commission
EFP	Emission Factors Program
E_o	error of omission
FF	vehicles failed by both the ST and the FTP
FTP	Federal Test Procedure
HC	hydrocarbon
I/M	inspection and maintenance
NO_x	oxides of nitrogen
PP	vehicles passed by both the ST and FTP
ST	short test
STE	short test effectiveness
STRR	short test rejection ratio
207(b)	reference to section 207(b) of the 1970 Clean Air Act